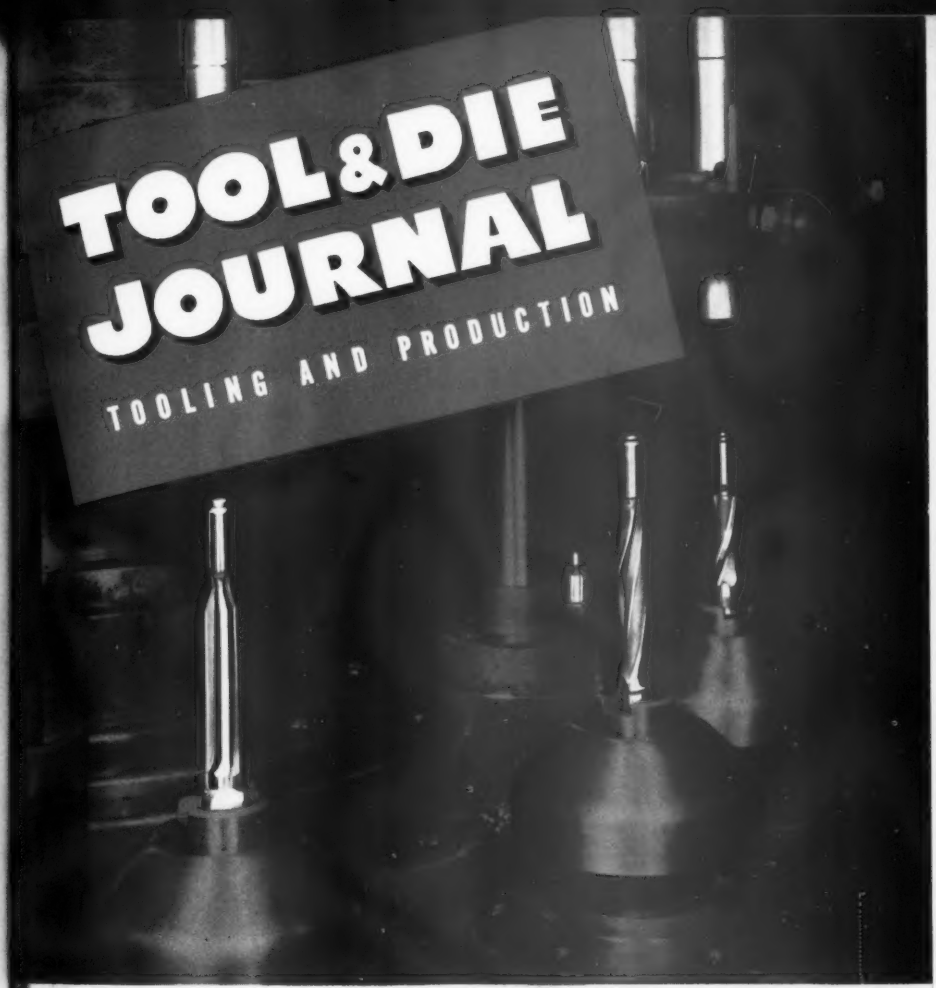


10 STATIONS—10 PUTNAM HI-SPEED TOOLS
FOR THIS CHAMBERING OPERATION

Illustrated is part of an automatic chambering machine, one of several manufactured by H. R. Krueger and Company. The machine forms and finishes the cartridge chamber at the rear of a machine gun barrel in ten operations. Extreme accuracy on every barrel is of great importance to assure uninterrupted performance in the field. Putnam Hi-Speed reamers and drills are standard throughout on these machines.

"For High Achievement"

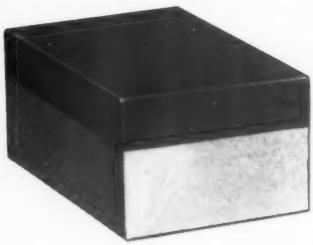
ARMY (E) NAVY

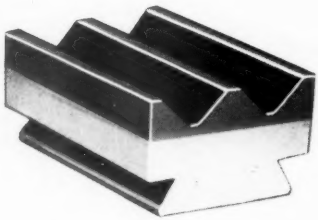
PUTNAM TOOL COMPANY

2985 Charlevoix Avenue • Detroit, Michigan

NOVEMBER, 1942 • 20,100 COPIES

NEW WAY TO CONSERVE HIGH SPEED STEEL





Dovetail forming cutters made from FCC Electrically Welded Composite Steel Blanks ***(high speed steel cutting face; mild steel base)*** **save at least 50% of high speed steel. Besides, they offer other distinct advantages. Obvious among them are:—**

1. **Non-hardenable, tough base minimizes tendency to crack and break out at sharp dovetail corners and screw holes during heat treating or when working.**

2. **Easier to drill and tap screw holes and machine dovetails in mild steel base; this work may be done** ***after*** **hardening if desired.**

3. **More prompt delivery because of reduced amount of high speed steel.**

4. **Inseparable bond between cutting face and base assured by special technique of electric welding.**

5. ***Marked saving of strategically important tungsten.***

Special Bulletin contains full particulars and prices.
Write for your copy of Bulletin TK today.

QUALITY FCC SERVICE

THE FORGING and CASTING CORPORATION

FERNDALE (DETROIT) MICHIGAN

"Performance has established leadership for HARDINGE High Speed Precision Machines"

HARDINGE High Speed Precision Machines with preloaded ball bearing spindle construction are *fast, accurate* and *dependable*. This combination, together with the ease and simplicity of operation, enables relatively unskilled operators to rapidly produce parts to the necessary close limits without expensive tooling.

HARDINGE
HIGH SPEED
PRECISION LATHE

HARDINGE
HIGH SPEED PRECISION
SECOND OPERATION MACHINE

HARDINGE
HIGH SPEED PRECISION
TOOL-ROOM LATHE

HARDINGE
HIGH SPEED PRECISION
MILLING MACHINE

THE TOOL & DIE JOURNAL

GEORGE J. HUEBNER ◆ EDITOR, PUBLISHER

Assistant Editors

DON E. ROOT

CHARLES H. HAYNES

Production Manager

MARY D. VECCIA

◆

Published monthly for key men responsible for designing, building and using Precision Tooling. The TOOL & DIE Journal is the official publication of The Tool & Die Institute. Controlled circulation covering certified operating executives, department heads and key men—CBI Coverage; others including Schools, Libraries and Students $1.50; Foreign $2.00; Single current copies 15c; Other available issues 20c. Advertising, Editorial and Circulation offices at 2460 Fairmount Boulevard, Cleveland, Ohio. Telephone FAirmount 4040.

Contents

Vol. VIII, No. 8 November, 1942

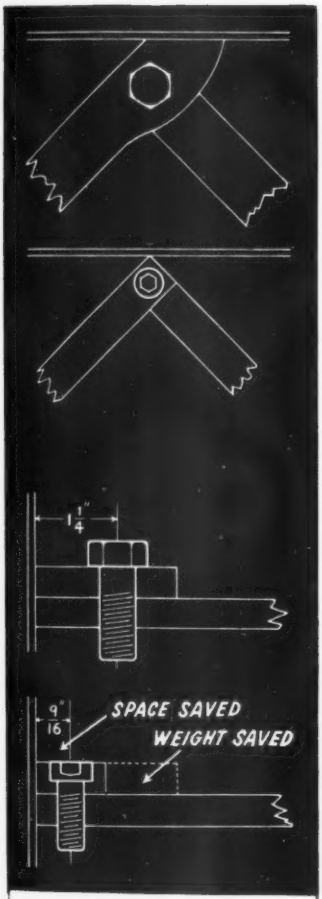
Letter From Washington—*George J. Huebner* 47
Metalurgency 48
Modern Milling Fixture Design—*C. W. Hinman* 53
Surface Finish Inspection—*H. S. Kartsher* 56
Getting the Most From Your Broaches—*Harry Gotberg* 60
Drilling and Tapping Cast Steel 62
Training For Victory Grinding Technique 67
Tool Salvage by Low Temperature Welding—*R. D. Wasserman* 85
Plasticator—*Gordon B. Thayer*, Technical Consultant 117
Loading the Injection Mold—*Don F. Hoffman* 118
Progress on Parade 130
Shop Aids 138
Publication Previews 158
Buy With Confidence 174
Advertisers Index 192

Copyright 1942 by George J. Huebner

ADVERTISING OFFICES—DETROIT: R. F. Pickrell, 314 Stephenson Bldg., TRinity 1-0790. CHICAGO: L. B. Hammond, 123 W. Madison St., RANdolph 1843. NEW YORK: H. Thayer Heaton, 415 Lexington Ave., MUrray Hill 2-1647. NEW ENGLAND: R. J. Weeks, 420 Lexington Ave., New York, MUrray Hill 4-7752. CLEVELAND: R. W. Thompson, 801 Caxton Bldg., MAin 3341.

Acceptance under the Act of June 5, 1934, authorized October 22, 1942

Save WEIGHT - SPACE - TIME



GUARANTEED *Unfailing* PERFORMANCE

HOLO-KROME *fibro forged* SOCKET SCREWS

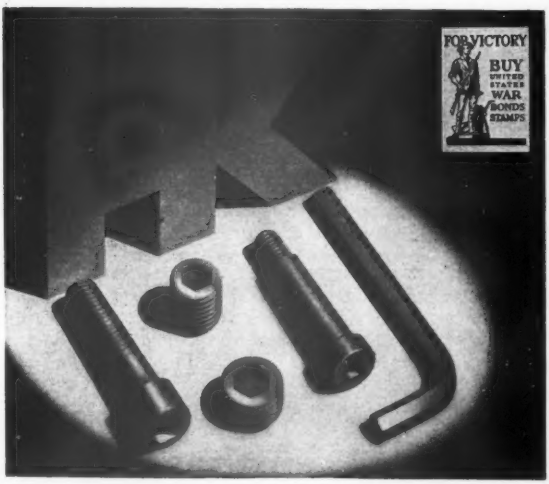
Here's the Facts — You *do* save

WEIGHT resulting in compact and efficient design.

SPACE saving every inch of valuable space because of the closer application in corners and hard-to-get-at places.

TIME by increasing speed in assembly because of the internal hex. driving feature.

THE HOLO-KROME SCREW CORP.
HARTFORD CONN. U. S. A.



ONLY *Bullets* SPEAK SOME PEOPLE'S LANGUAGE

"SAY it with bullets" appears to be the slogan of the aggressor. To which there is only one reply—more and deadlier bullets returned to those who invited them, so that the world can live in peace again.

The manufacture of bullets requires precision tools and dies designed and built to most exacting specifications. Ohio Tool acquired the experience and skill in making tools that make the bullets long before the war began. Since Pearl Harbor, our facilities for this production have been tremendously increased. For more than a year, producing these tools has been our job—100%. We intend to keep at it until the war is won.

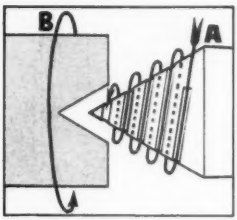
OHIO TOOL COMPANY

CLEVELAND, OHIO

Manufacturers of Small Arms Ammunition Tools

DESIGNERS AND BUILDERS OF TOOLS, DIES, JIGS, FIXTURES, GAGES AND SPECIAL MACHINERY

ONLY CMD *Helical Groove* CENTERS



*The **exclusive** left-hand helical groove constantly conveys supply of oil to the extreme point of the center and holds a reserve supply of lubricant. Since the lubricant flows to the bearing surface in the same direction (see A above) as that in which the work is turning (see B), the capillary action draws the lubricant into the work.

CMD Center Point Lubricant

can withstand pressures greater than 50,000 lbs. per square inch. Try it once! You'll use it regularly!

Give You All of These Cost-Reducing Advantages

● GREATER MACHINE OUTPUT

The advanced design* of CMD Helical Groove Centers assures more *complete* and *longer-lasting lubrication* of point and work. No more burned-out center points! No stopping machine to relubricate center! No readjustments of tail stock!

● RIGIDITY FOR PRECISION WORK

Because CMD Helical Groove Centers do *not* turn with the work, there are no rollers, balls, or races to wear out and throw the support for work out of alignment. The work turns on a film of oil, which is constantly replenished from the supply in the helical groove.

● LESS POWER CONSUMPTION

By reducing frictional heat to the minimum, CMD Helical Groove Centers prevent excessive expansion of work (a common cause of high power costs). The lubricant on work and in groove also helps to expel heat generated by cutting tools.

Write for FREE *Sample Kit*

CHICAGO MANUFACTURING & DISTRIBUTING CO.
Dept. J-11, 1928 West 46th St., Chicago, Ill.

☐ Send circular on CMD Helical Groove Lathe Centers
☐ Without obligation to us, send FREE sample kit containing a tube of CMD CENTER POINT LUBRICANT and a tube of CMD CENTER POINT LUBE (grease) with directions for making an amazing, simple test.

NAME .....
FIRM NAME .....
ADDRESS .....

EMPCO *Announces*

NEW MACHINE LEVELING JACKS

Self-aligning, Two-Way Control, Smooth Slip-ways, etc.

The New EMPCO JACK has been redesigned from the best suggestions of its users and will be found distinctly advantageous in every way.

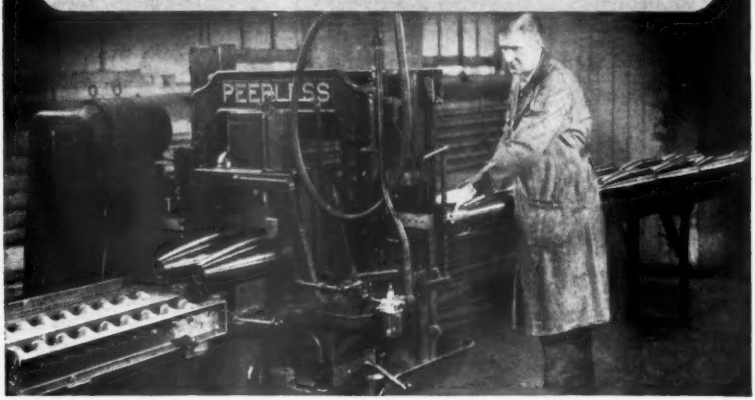
For quick, economical, temporary or permanent machine set-ups on new or old floors, the New EMPCO Leveling Jacks are TOPS. Entire operation of maintaining machines level as well as setting them up is greatly simplified: Merely apply a wrench to the "hex" screw heads until the spirit level reads zero.....That's all!

See them illustrated here next month or write for full particulars.

EMPCO

ENTERPRISE
MACHINE PARTS CORPORATION
2735 JEROME AVENUE • DETROIT, MICHIGAN

Safe FOR MEN AND METAL ...PEERLESS POWER SAWS



Haste with waste never was sound shop practice! And, today speeds that sacrifice SAFETY cannot be tolerated.

Fast cutting with maximum safety for men and metal has won broad acceptance for Peerless Power Saws in our war industries. Peerless cool-running, straight-cutting blades remove as little as 1/16" of the metal. These fine cuttings are easily salvaged from the chip tray.

While sawing test samples for the Dow Chemical Company, a 14" Peerless High Duty (like the machine shown in the illustration above) cut 10½ sq. in. per minute. The bar of Dow metal was 11¾ inches in diameter — 108.43 sq. in. per cut. A two-tooth blade was used.

Peerless Power Saws also release their operators for other productive work while the cutting progresses smoothly and quietly. The patented, Peerless Four-Sided Saw-Frame, with Backing-Plate Blade-Support guards the life of the blade. Should the blade grow dull and break, under strain caused by neglect, the Peerless stops *automatically* before injury can be caused to MEN or METAL . . . Peerless effectively combines SPEED with SAFETY! The coupon entitles you to a set of the latest literature.

PEERLESS MACHINE COMPANY • Racine, Wis.

Peerless METAL SAWING MACHINES

PEERLESS MACHINE COMPANY
Dept. TDJ-1142, Racine, Wisconsin
Mail catalog on Peerless Heavy Duty Vertical.

Company.....

Individual.....

Street.....

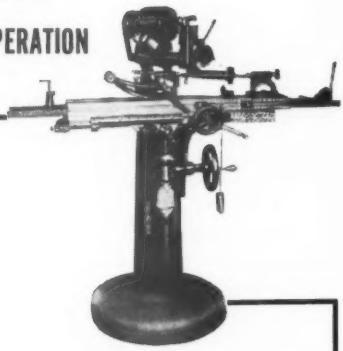
City.....State.....

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

CIRCULAR RELIEF GRINDING

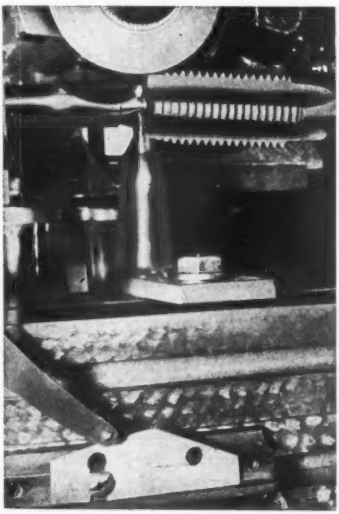
with no "land"

ONE MACHINE • ONE SET-UP • ONE OPERATION

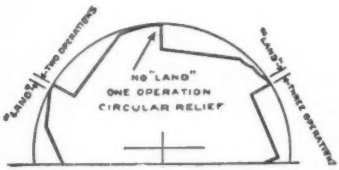


THIS IS ALL DONE IN ONE OPERATION

1. Dress the face of the grinding wheel so it has exactly the same curve as the tool to be ground.
2. Offset the tool from the center of the curve of the wheel to give desired clearance.
3. Grind clear to the cutting edge.



COMPARING CONVENTIONAL GRIND WITH CIRCULAR RELIEF GRIND



Because the tool has been ground with the circular relief exactly the same as the curve of the tool, the outside of the tool is left convex. Therefore, all the metal possible has been left behind the cutting edge to give it maximum support, and the tool longer life.

The degree of clearance is determined by the distance the tool is moved in or out against the curved face of the grinding wheel.

EXCELLENT DELIVERY

Write for complete details

THE CLEVELAND TOOL ENGINEERING CO.

9105 Detroit Avenue ∴ Cleveland, Ohio

A NEW TYPE MACHINE

DEVLIEG JIGMIL

No. 3-A
3" BAR

To more accurately and speedily serve the broad field needing a machine having

• • •

THE SPACING ACCURACY OF A JIG BORER

• • •

THE PERFORMANCE QUALITIES OF A MILLING MACHINE

• • •

THE CONVENIENCE AND FLEXIBILITY OF A HORIZONTAL BORING MILL

☆ A PRECISION MACHINE ☆

Featuring

NEW SPEED OF OPERATION

NEW ADVANCED FINGER TIP CONTROLS

NEW STANDARDS OF EXCELLENCE OF BORED HOLES

NEW ACCURACY IN MILLING

AUTOMATIC TABLE RETRACTION AND REPOSITIONING

Many machines in operation show 75% greater average daily productivity and improved dependability for precision.

Write for Circular

DEVLIEG MACHINE COMPANY
452 FAIR AVENUE, FERNDALE (DETROIT), MICHIGAN

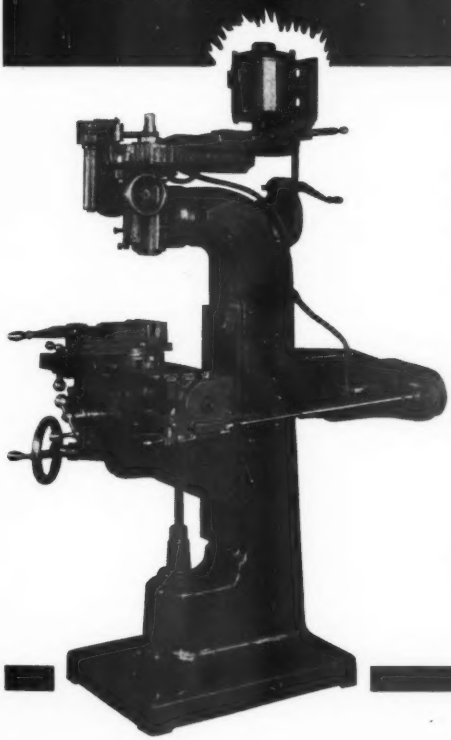
DEVLIEG MACHINE TOOLS

TRIPLE THREAT MACHINE

With

Vernier Precision

FOR MILLING, DRILLING AND BORING ON TOOLS, DIES, EXPERIMENTAL AND PRODUCTION WORK



Constant pounding, twenty-four hours a day, seven days a week has been the task of hundreds of INDEX MILLS and they are doing the job so well that a large percentage of our orders are repeats.

If you do not know about this remarkable machine made by INDEX you should write today to

Blank & Buxton Machinery Company

3110 E. Michigan Ave., Jackson, Michigan

LET SKILLED HANDS DO REAL WAR WORK

Too much lifting and carrying of heavy loads mean "too little" production and "too late" delivery

AMERICAN MONORAIL Overhead Handling Equipment will eliminate delays in your production—from unloading raw materials to loading your finished products. In every operation where handling is involved, American MonoRail Engineers have been able to speed up production by eliminating delays, relieving skilled labor from lifting and carrying, reducing accidents, conserving energy and increasing efficiency.

Call in an American MonoRail Engineer—he will show you how it can be done in your plant.

THE AMERICAN MONORAIL CO.
13124 **Athens Avenue** **Cleveland, Ohio**

THE AMERICAN MONORAIL CO.
13124 Athens Avenue, Cleveland, Ohio

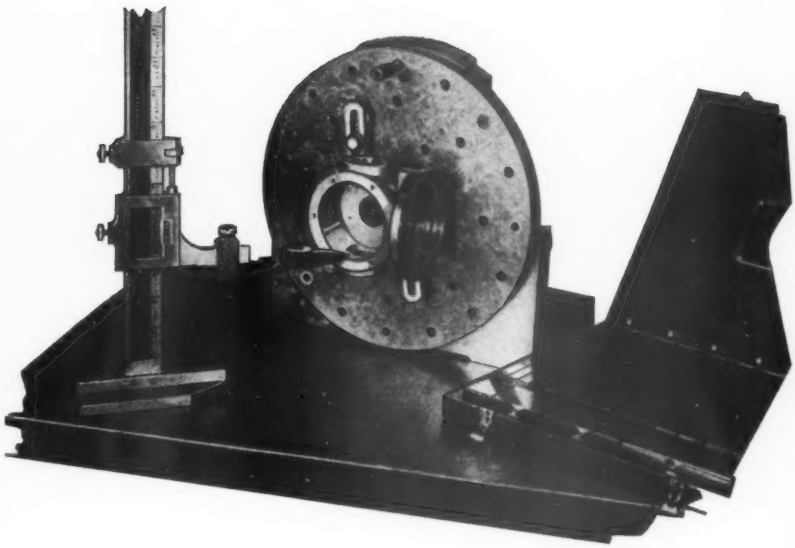
Gentlemen:

Please send Blue Book ☐ Send the American MonoRail Engineer ☐

Company .....

Name .....

City ..... State.....



The Becker Index Master
has gone to War for Victory

The Bunell Machine & Tool Co. is proud of the part the Becker Index Master is playing in our victory program. This versatile precision unit is doing a double duty—it accurately and speedily determines parts' conformance with drawing specifications.

Comparing the present methods used in the inspection and layout of tools and parts where a bevel protractor sine bar must be set for each dimension, the great time saving advantages of using the Becker Index Master can readily be seen.

THE BUNELL MACHINE & TOOL CO.
1620 E. 24th St. Cleveland, O.

Tune in on

T-04*

FIRTHITE

Universal grade for heavy duty, interrupted cuts, and coarse feeds, on older machines.

TA*

FIRTHITE

General-purpose grade for cutting steels under "average" conditions.

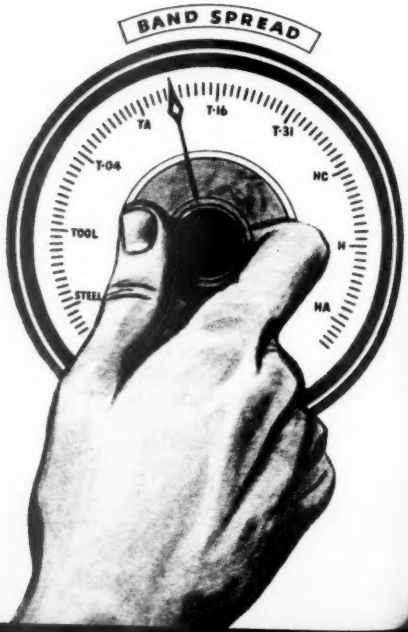
T-16*

FIRTHITE

The grade for fine, extremely fast machining of steel.

T-O-O-L S-T-E-E-L

High-grade tool steels including Circle "C," Blue Chip, Star-Mo, Firth-Sterling Special, etc.



FIRTHITE

SINTERED CARBIDES

for Complete Shop Tooling

T-31*

FIRTHITE

Hardest, wear-resistant, premium grade for precision boring, etc.

HC

FIRTHITE

For coarse feeds on soft materials at slow speeds, skiving brass, grooving aluminum alloys.

H

FIRTHITE

Most dependable grade for general use in roughing softer materials.

FIRTHITE

MODERN MATERIALS
FOR COMPLETE SHOP TOOLING

HA

FIRTHITE

Best grade for finishing hard, abrasive irons, non-ferrous and non-metallic materials.

Firth-Sterling

STEEL COMPANY

OFFICES: McKEESPORT, PA. NEW YORK HARTFORD LOS ANGELES CLEVELAND CHICAGO PHILADELPHIA DAYTON DETROIT

* Made under one or more of the following patents on TITANIUM Carbides: 2,246,387; 2,265,010; Re 22,073; Re 22,166.

ON THE SPOT WITH A PRODUCTION PROBLEM?

. . . . SEND A WIRE TO THE EMERGENCY PRODUCTION SERVICE DEPT. OF KEARNEY & TRECKER

Getting the tools to do the work is often more of a problem than the production job itself. Sometimes it just gets down to having the *know how* to use present equipment or merely adding a standard attachment which adapts or converts an existing milling machine in your plant to a particular operation.

When you are on the spot with a difficult milling job the Emergency Production Service Department of Kearney & Trecker Corporation is at your service. They have the *know how* to be able to suggest getting the most in performance from your present Milwaukee milling machines . . . to extend their range of application and usefulness with standard attachments and accessories.

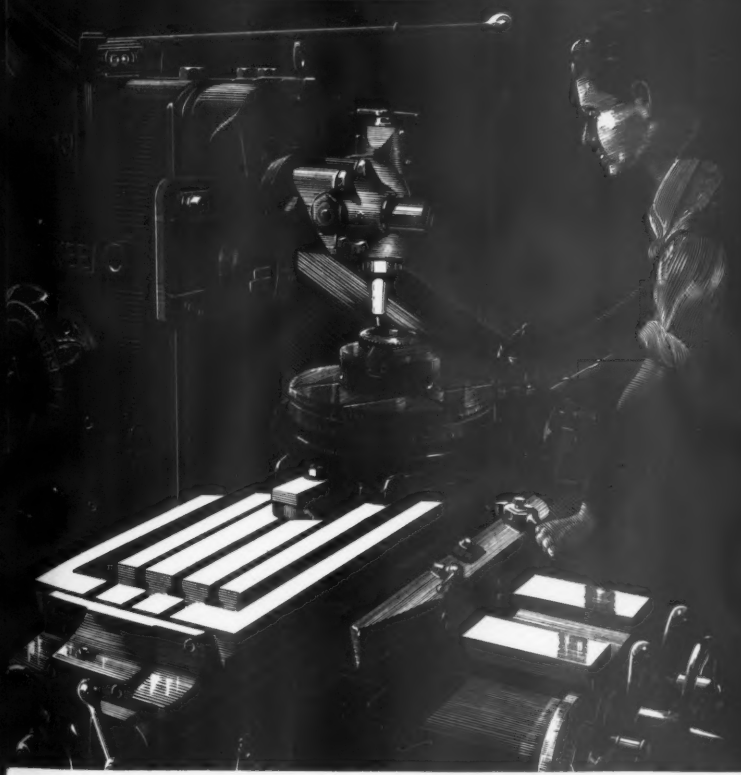
Kearney & Trecker believes that their Emergency Production Service can help you just as it has helped others faced with production problems. To avail yourself of it all you need to do is pick up your telephone and send a wire, stating your problem, to this Department. Immediately upon receiving your wire, arrangements will be made to have a trained field representative contact you at once. Depending upon the nature of your problem he will provide you with complete technical information or call directly at your plant.

The Emergency Production Service Department of Kearney & Trecker is maintained for your benefit—to aid you in your war effort. We urge you to make use of it.

Here is an exceedingly versatile attachment that should be put to work in your plant — to relieve machine shortage — to avoid the difficulties of getting new machines — to add to the range and usefulness of your present Milwaukee Milling Machines. It's the Standard High-Speed Adjustable Universal Milling Attachment, shown above in use in conjunction with a low lead attachment and rotary table for end milling a scroll. This is but one of many applications of this versatile tool, such as milling on dies, metal patterns, templets, T-slots, dovetails and other milling operations. When used with a rotary table, circular milling operations can be performed. When used with a dividing head with lead attachment spiral milling operations can be accurately and rapidly performed.

Milwaukee MACHINE

THIS ATTACHMENT *PINCH-HITS* ON MANY PRODUCTION JOBS...



Look into this and many other Milwaukee milling attachments—to help solve particular milling problems—to break production bottlenecks—to extend the use and range of application of your present Milwaukee Milling Machines. Write for the complete file of literature on Milwaukee milling attachments.

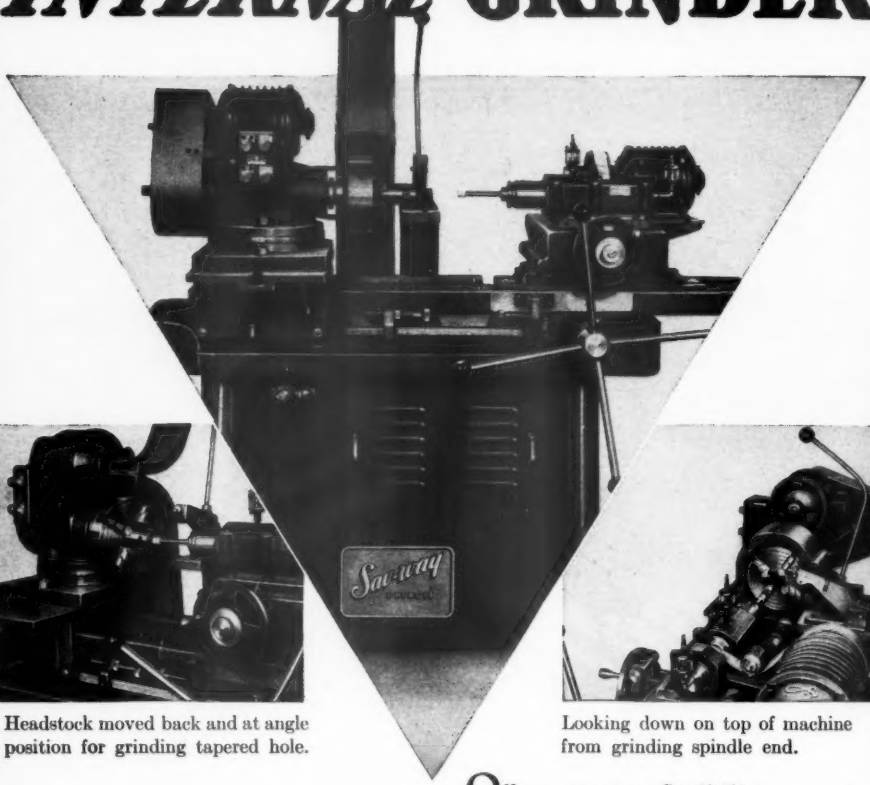
KEARNEY & TRECKER CORP.
Milwaukee, Wisconsin

Write for handbook "Right and Wrong of Milling Practice"—to aid your men to become better milling machine operators.

KEARNEY & TRECKER
CORPORATION

T O O L S

Saw-way MULTI-PURPOSE INTERNAL GRINDER



Headstock moved back and at angle position for grinding tapered hole.

Looking down on top of machine from grinding spindle end.

Offers greater flexibility . . . a precision grinder, designed and built by engineers with years of practical experience to guide them . . . has a headstock traverse of 6″ . . . grinds holes ¼″ to 18″ in diameter . . . holes up to 9″ deep, straight or tapered . . . entire headstock may be moved at right angle to wheel traverse, by merely loosening two conveniently located nuts . . . worm compensating device permits grinding wheel head adjustment to .0001 . . . sturdy construction throughout . . . full specifications, delivery time and price on request.

Distributors throughout the U. S. and Canada to serve you.

Saw-way TOOL AND MACHINING CO.

13836 JOS. CAMPAU AVE. DETROIT, MICHIGAN

SCRAP piles are much more than mere collections of trim ends, cuttings, useless machines, parts and junk these days. They're vital national resources—*American Treasuries,* in fact, in this critical year; because the nation's steel producers will need several million more tons of scrap in 1942 than ever before, if the demands of war production are to be met. ● How much can *you* contribute? Not just the usual scrap flow from your operations, but *all* the idle metal around your buildings and yards that it isn't absolutely essential to keep. Your deposit in the scrap bank will pay dividends all over the world—*make it a real one!*

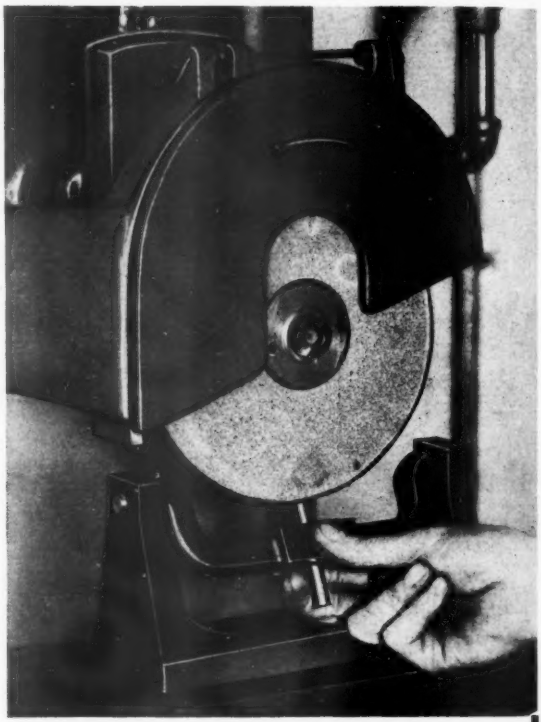
Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA

"LITTLE WONDER" RADIUS DRESSER
SAVES TIME IN EVERY GRINDING ROOM

The "LITTLE WONDER" RADIUS DRESSER will dress radii from 0 to 1" quickly and conveniently. This is a time-saving device for every grinding room. May be simply and accurately set by micrometers or gage blocks. It does not contain bearings which may become clogged with emery. It will dress either convex or concave radii and is free from chatter.

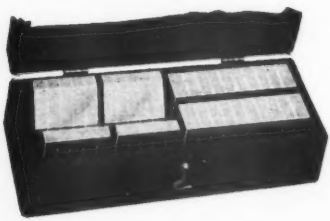
Price, $39.50.
Cold set dressing tool, 1/3 carat, $6.50.

Place your order now subject to approval and actual trial in your shop.



ELIMINATE SPECIAL CLAMPS and HOLDING DEVICES WITH MAGNE-BLOX

The MAGNE-BLOX set illustrated consists of two parallels measuring 1"x1¾"x3¾" and two V-blocks measuring 1¾"x2⅜"x1⅞". This set has been designed for holding work for surface grinding operations that cannot be placed directly upon the plane surface of the magnetic chuck itself.



MAGNE-BLOX are made of alternate laminations of brass and a specially selected iron of high magnetic capacity.

YOU CAN USE A SET FOR EVERY SURFACE GRINDER IN THE SHOP

PRICE, complete in case ----------$14.50

Order now for prompt delivery. Write, wire or telephone Canal 6-1464 and place your orders without delay.

GEO. SCHERR CO., INC.

128-B LAFAYETTE ST.
NEW YORK, N. Y.

THE NEW Thompson

SPRING COLLET Adapter

The Thompson Spring Collet Adapter is new in design — efficient in action. Consisting of only two parts it fits all standard spring collets — grips tight, no slipping — accurate. Made for all taper spindle machines, it eliminates heavy, bulky chucks — gets closer to work. Time saving, economical. Give your mechanic a better adapter — specify "Thompson."

Write for literature and prices of special adapters.

TRADE MARK Thompson REG U.S. PAT. OFF.

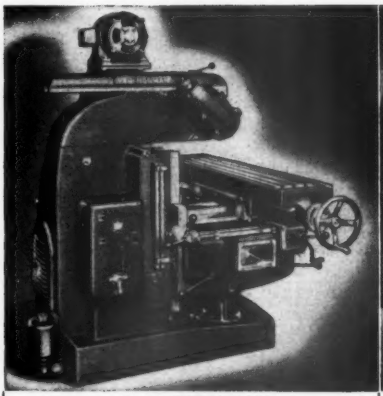
AUTO-ORDNANCE CORPORATION

THOMPSON TOOL DIVISION

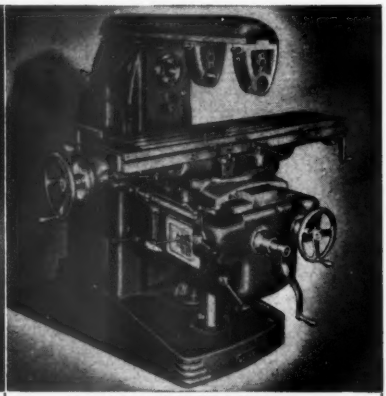
342 WEST PUTNAM AVENUE GREENWICH, CONN.

Tools of Peace are now

WEAPONS OF WAR



NO. 26 RAM-TYPE MILLER
Table: 50" x 12"
Range: 28" longitudinal, 12" cross, 18" vertical



NO. 2-S HORIZONTAL MILLER
Plain and Universal
Table: 50" x 12"

THE VAN NORMAN LINE OF MILLING MACHINES needed no redesign for wartime operations . . . and they have required no radical changes since. For more than 50 years of development had given these precision tools the highest adaptability to the most exacting requirements for speed and accuracy that could be imposed *either* in peace or war. Today, Van Norman Vertical, Horizontal, Ram-Type, Contour and Hand Millers are helping to keep vital war work up to . . . and in many cases, *ahead of* . . . schedules in key production plants of all the United Nations. They are making it possible to turn out quality work in unprecedented quantity because of their extreme ease of operation and control, which not only saves time for skilled operators, but also helps new operators to learn their jobs more quickly.

VAN NORMAN MACHINE TOOL CO., SPRINGFIELD, MASS.

Van Norman

MILLING MACHINES

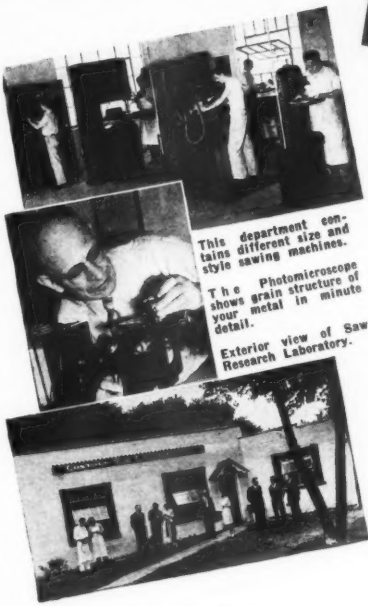
In June, 1942, Van Norman was awarded the Army and Navy E in recognition of its war production record

YOUR SAWING JOBS PRE-TESTED

A typical case: Heyl & Patterson, Inc., of Pittsburgh, Pa., sent a 6½" bronze bushing through our Laboratory.

55 separate cuts were tried
4 different width saws
40 speeds
3 lubricants
Several pressures
Various angles

Result: Use a DoAll 8 pitch band saw, 2 temper, raker set, 1" wide. Tilt table 10 degrees and run at 100 f.p.m.



This department contains different size and style sawing machines.

The Photomicroscope shows grain structure of your metal in minute detail.

Exterior view of Saw Research Laboratory.

First and Only Saw Research Laboratory Open to Industry

A clinic where hundreds of intricate sawing jobs are handled. This brand new building, with the most modern scientific apparatus, is manned by top-ranking engineers. They determine the fastest and easiest method to saw any kind of metal, alloy, Masonite, magnesium, plymetal, etc., with maximum savings of time, metal and saw blades.

Have You A Tough Job?

Send along the actual job for a series of tests by our experts. They will send you promptly a detailed written report with their findings. No cost or obligation.

Send for 32-Page Book

Contains illustrations and facts about actual performance records of DoAll Saws.

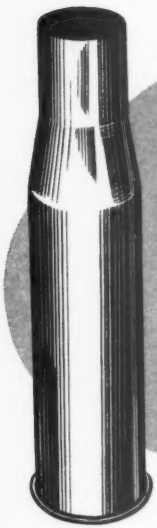
THE DOALL COMPANY

1203 Thacker St., DesPlaines, Illinois
Associated with Continental Machines, Inc., Minneapolis, Minn.

DoAll BAND SAWS

These hard-toothed little fellows last longer and are doing work in plants everywhere in ½, ¼ and even ⅛ the time of former methods. The finish is so smooth that further machining is unnecessary.

Each 100-ft. coil comes in slotted metal box. Complete line contains 48 different styles, ⅛ to 1" wide.



SPEEDING

Steel Shell Production

Gilron compounds are now doing a real job drawing steel cartridge and shell cases. Aiding in the development work, Gilron engineers have been instrumental in increasing production for leading manufacturers.

20 mm to 105 mm steel shell cases can be produced with the new water soluble non-toxic coating compound, thus eliminating copper plating.

Because of the high film strength of Gilron drawing fluid, three draws are made without scratching or scoring before recoating is necessary.

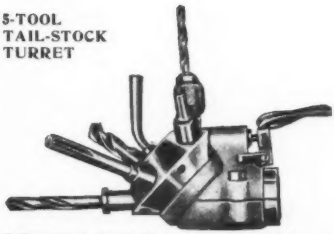
A convincing list of satisfied users will be furnished on request, together with complete production details.

Gilron

PRODUCTS CO., INC.

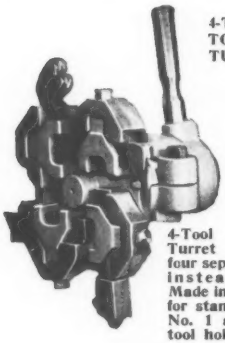
1557 EAST 40th STREET · CLEVELAND, OHIO

5-TOOL
TAIL-STOCK
TURRET



5-Tool Tail-Stock Turret accommodates five tools and each tool centers automatically when brought into position by means of an indexing plunger. Made in four sizes to fit small bench lathes up to lathes with 24" swing.

4-TOOL
TOOL-POST
TURRET



4-Tool Tool-Post Turret carries four separate tools instead of one. Made in two sizes for standard 0, 00, No. 1 and No. 2 tool holders.

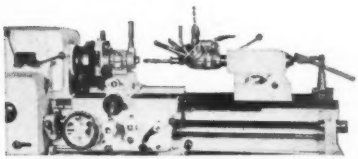


Photo above shows Jefferson Turret Attachments on 16" Engine Lathe.

"BULL DOG"
PRECISION
MILLING MACHINE

This motor driven power feed precision milling machine is capable of close tolerances on die sinking, contour profiling, angular milling, jig boring, routing of ferrous, non-ferrous metals, fibre and plastics for production line or toolroom. Has 4 spindle speeds: 200, 400, 700 and 1000 R.P.M.—Write for details.

ENGINE LATHE TO TURRET LATHE

in 15 seconds

Don't wait for Turret Lathes . . . You can convert any engine lathe into a complete precision turret lathe in 15 seconds with the Jefferson 4-Tool Tool-Post Turret, 5-Tool Tail-Stock Turret and Adjustable Pull Feed—and double its capacity. For forming, roughing, boring, finishing, drilling, tapping, etc.

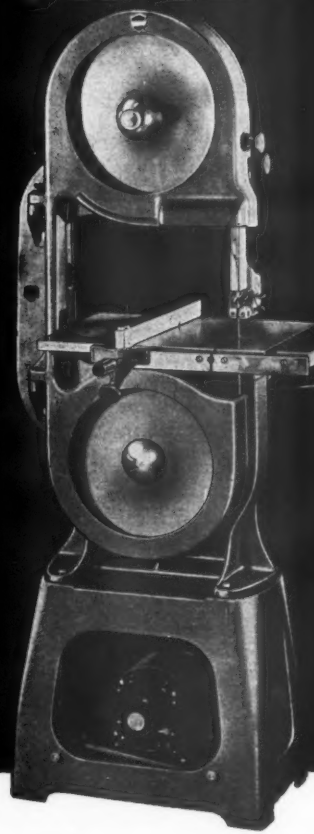
Jefferson Turrets are real production tools—substantial, rigid, accurate and adaptable to any size or make of engine lathes. They must not be confused with the small makeshift gadgets now on the market.

Adjustable Pull Feed eliminates slow movement of tail-stock spindle and provides easy control. For any lathe up to 24" swing. Delivery, 6 days. Write for Details.

JEFFERSON MACHINE TOOL CO.
710 N. Fourth St., Cincinnati, Ohio

Tool-Post Turrets, Tail-Stock Turrets, Adjustable Pull Feeds, Belt Sanders, Gyratory Foundry Riddles, Overhead Swing Frame Grinders, Milling Machines, Dividing Heads and Vises.

You're Money Ahead with DURO BAND SAWS Increased Production at Low Cost . . .



These saws are designed and built to give long satisfactory service. Rigid castings — oversize New Departure ball bearings—precision construction —statically and dynamically balanced wheels — all controls and adjustments at front, speed up production.

Equipped with built-in light, tilting table and mitre gauge.

Equally satisfactory for wood, metal, plastic, etc.

DEFENSE DEMANDS DEPENDABILITY

DURO FOR DURABILITY

DURO METAL PRODUCTS CO.

2649 N. KILDARE AVE. DEPT. TP-23 CHICAGO, ILL.

Welch

QUICK DEMAGNETIZER

Operates on **220 VOLTAGE** A. C. 60 Cycle

"Another Welch Product"

INSIDE MEASUREMENTS APPROXIMATELY 4″x11″

•

A REMARKABLE TIME SAVER

AN outstanding unit needed wherever magnetic chucks are used. Operates on 220 voltage. Any ordinary sized pieces, such as cutters, gears, washers, etc., can be demagnetized by a single pass through its powerful field. Can be easily connected by your own electrician in any convenient location in your plant. Equipped with convenient switch. (If your power is other than 220 volt, 60 cycle, A.C., kindly let us know.) Carried in stock for immediate delivery. 10 DAYS FREE TRIAL IF DESIRED.

Price $120.00

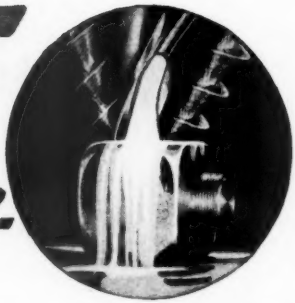
Write for particulars

Welch INDUSTRIES, INCORPORATED

Makers of High Speed Milling Cutters — Form Tools and Special Tools

20000 WEST EIGHT MILE RD. DETROIT, MICHIGAN

SAVE CUTTING TOOLS-



INSTALL

GRAY Portable COOLANT SYSTEMS

HEAVY DUTY MODELS
For drill presses, turret lathes, milling and honing machines.

STANDARD MODELS
For hand screw machines, grinders, milling machines and drill presses.

COOLANTS . . . properly applied . . . will greatly improve tool production. Proper coolants permit higher cutting speeds . . . more pieces per hour. Improvement in tool life reduces loss of time for tool changes . . . adding many hours of productive time and SAVING CUTTING TOOLS.

GRAY Portable Coolant Systems help prolong the life of hard-to-get machine tools. Their portability and flexibility of design make installation a quick and easy matter. They provide . . . by controlled flow . . . the exact amount of coolant, right where it is needed, with ample pressure to reach the vital spots. Modernize your machine tools this economical way.

COMPLETE COOLANT SYSTEMS

GRAY Precision-Built Pumps, "Flo-Bac" Coolant Pans, Valves, Brackets and Fittings, used together, provide a highly efficient coolant system that can be installed in a few minutes. There are heavy duty pumps capable of handling ten or more applications. "Flo-Bac" Coolant Pans and Fittings are carried in stock for many machines or made to your specifications. INVESTIGATE TODAY!

6 PUMP MODELS—3 Standard Models, 3 Heavy Duty Models. From 50 G.P.H. to 165 G.P.H. high pressure capacities.

PRICES FROM $39.50 to $99.50

"FLO-BAC" COOLANT PANS, BRACKETS, VALVES AND FITTINGS

Complete fittings for one, two, three, four and six spindle units carried in stock. Special set-ups built to order.

Ask Your Distributor—or Write For Literature

GRAY-MILLS CO.

211 W. ONTARIO ST. • CHICAGO, ILLINOIS

PORTABLE COOLANT PUMPS — "FLO-BAC" PANS, COOLANT FITTINGS AND COOLANTS

there is a difference in TAPS

4 good reasons why

SOSSNER taps last longer and cut more perfect threads

1

CUTTING . . Sossner taps are carefully fluted to precise depth and width for maximum strength and best cutting angle.

2

STRUCTURE . . . All Sossner taps are treated in time-temperature-atmosphere controlled furnaces!

3

FINISH . . All Sossner taps are expertly ground from the hardened solid blank using the very latest equipment and our own newly developed methods.

4

ACCURACY . . . Only the most modern and accurate equipment is used to check the form and lead. Every tap is measured with precision wires on master measuring instruments calibrated to .0001 in.

ENGINEERING SERVICE AND ESTIMATES PROMPTLY GIVEN ON SPECIAL AND STANDARD SIZES

Write to SOSSNER, 163 Grand St., N. Y. C. or 28 B'way, Lynbrook, N. Y.

SOSSNER

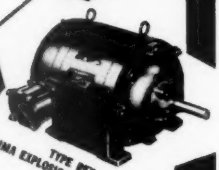
TAPS · GAGES CUTTING TOOLS MARKING DEVICES

LIMA

ENGINEERED PERFORMANCE

TYPES F1 AND F2
LIMA GEARSHIFT DRIVES

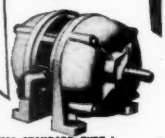
TYPE R. S.
LIMA SPLASH-PROOF MOTOR



TYPE REX
LIMA EXPLOSION PROOF MOTOR

TYPE F1D
LIMA GEARSHIFT DRIVE

TYPE F2D
LIMA GEARSHIFT DRIVE



LIMA STANDARD TYPE L
ALL-PURPOSE MOTOR

LIMA MAGNETIC
POLISHING LATHE

Lima Electric Motors, Lima Gearshift Drives and Lima Magnetic Polishing Lathes, have proven themselves on the War Production Front.

In addition to simplicity of design and ease of installation, Lima's are engineered to meet the War Production Board's constantly increasing demands on production machines in your plant. Lima engineers, aware of today's vital speed requirements, are at your service—consult them on any questions of motorizing your production equipment. Proven engineering recommendations are at your disposal . . . Keep War Production up with LIMA ELECTRIC MOTORS — LIMA GEARSHIFT DRIVES — LIMA MAGNETIC POLISHING LATHES.

PROMPT DELIVERIES

LIMA ELECTRIC MOTORS - SIZES ½ to 75 H.P.
FOUR TYPES OF LIMA GEARSHIFT DRIVES
TYPE F1 DIRECT DRIVEN UNITS 1 to 5 H.P.
TYPE F2 DIRECT DRIVEN UNITS 7½ to 25 H.P.
TYPE F1D BELT DRIVEN UNITS 1 to 5 H.P.
TYPE F2D BELT DRIVEN UNITS 7½ to 25 H.P.
LIMA MAGNETIC POLISHING LATHES

THE LIMA ELECTRIC MOTOR CO.

LIMA, O. *OFFICES: NEW YORK · CHICAGO · DETROIT* U. S. A.

LIMA ELECTRIC MOTORS · LIMA MAGNETIC POLISHING LATHES · LIMA GEARSHIFT DRIVES

190 SURFACE FEET PER MINUTE with GRAPH-MO Steel

Mr. H. F. Braun, General Manager of The Taylor Precision Manufacturing Company, reports that his operators are machining Graph-Mo Steel for small arm punches at speeds as high as 190 surface feet per minute with .012" feed and .030" cut. These tools are heat-treated and used at hardnesses up to Rockwell C 65 on the working ends.

This northern Ohio manufacturer says that Graphitic Steel machines 25% faster than carbon tool steel, is less subject to distortion, provides an excellent finish after grinding, and wears longer.

For further information on Graphitic Steels, write on your company's letterhead and ask for a copy of "The Graphitic Defense Handbook".

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO
Steel and Tube Division

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
GRAPHITIC STEELS

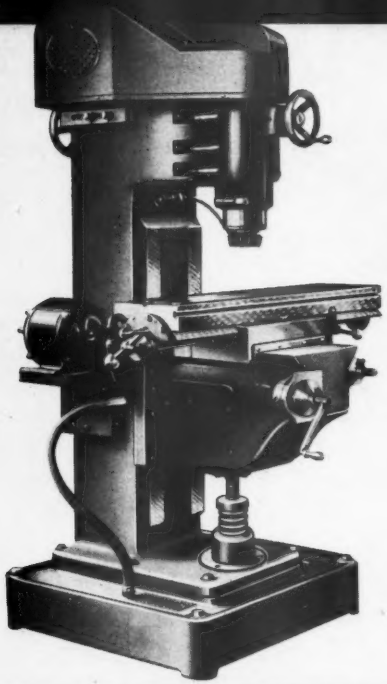
War or Peace ... the advantages are the same... longer wear, easier machining... that's Graphitic Steel.

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

HELP ASSURE VICTORY

Buy War Bonds. Conserve Rubber. Eliminate Unnecessary Travel. Use the Telephone Only When Important. Salvage All Scrap and Waste Material.

ANOTHER BOOST FOR VICTORY!



JACKSON No. 2½

Precision Built-Heavy Duty

VERTICAL MILLER

Drive: 1½ H. P. Motor; V-Belt, Worm and Worm Gear.

12 Speeds; 9"x 39" Table.

Travels: 14" vertical, 10" cross, 23" longitudinal; 4" vertical spindle.

Weight: 2400 pounds.

Long. Power Feed and Automatic Coolant.

Shipments now being scheduled for next 90 day deliveries under W. P. B. Order L-1-B. Phone or Wire.

JACKSON

MACHINE & TOOL COMPANY

• SALES DIVISION •

JACKSON, MICHIGAN

U. S. A.

PRECISION

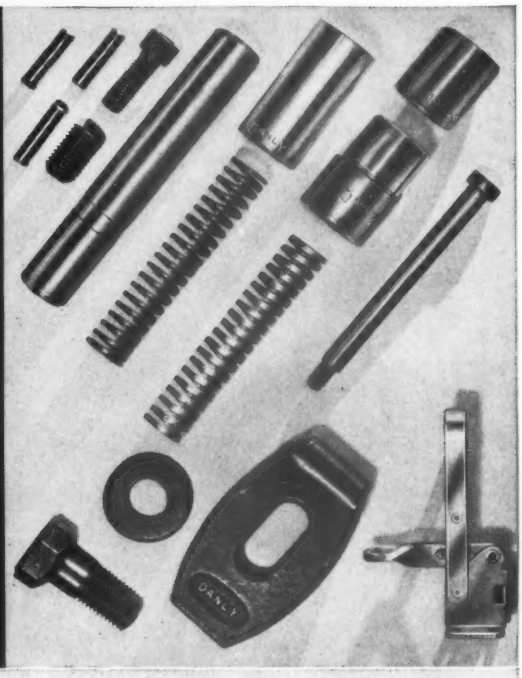
IN DIMENSIONAL ACCURACY
IN DAILY PERFORMANCE

DANLY
PRECISION
DIE MAKERS' SUPPLIES

—

DOWEL PINS
SCREWS
SPRINGS
POSTS & BUSHINGS
CLAMPS

—



WRITE OR CALL YOUR DANLY BRANCH

DANLY MACHINE SPECIALTIES, INC.
2100 So. 52nd Ave., Chicago, Ill.

111 E. Wisconsin Ave., **Milwaukee, Wis.**
47-28 37th Street, **Long Island City, N. Y.**
990 E. Momument Avenue, **Dayton, Ohio**
1549 Temple Avenue, **Detroit, Michigan**
16 Commercial Street, **Rochester, N. Y.**
1550 E. 33rd Street, **Cleveland, Ohio**
3913 North Broad Street, **Philadelphia, Penna.**

Ducommun Metals & Supply Company, Los Angeles, California; San Francisco, California

DANLY DIE SETS and DIE MAKERS' SUPPLIES

Now Production must be Geared for BATTLE!

WHERE PRODUCTION counts most . . . in Aircraft and other munitions manufacturing . . . Boyar-Schultz Profile Grinders are helping speed this important work to a victorious end.

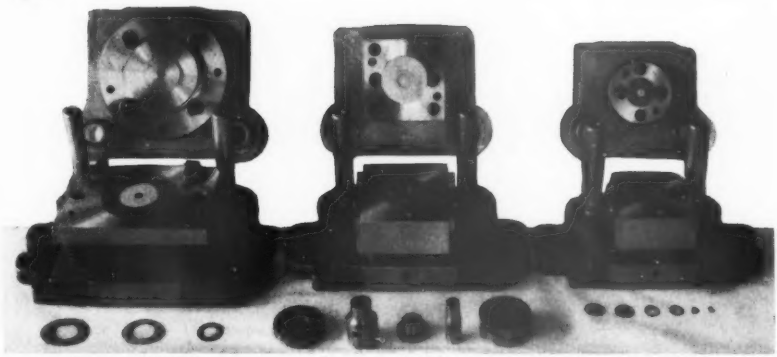
A Boyar-Schultz Profile Grinder may be just the machine tool you need for solving intricate grinding problems in your tool room or your production system.

Write for Circulars

BOYAR-SCHULTZ CORPORATION
2112-M WALNUT ST. CHICAGO, ILL.

DON'T WASTE CRITICAL STEEL

Use HOVIS UNIVERSAL WASHER DIES



Capacity 2½" Dia. Capacity 1½" Dia. Capacity ¾" Dia.

NOTE THIS TREMENDOUS SAVING!

THE OLD WAY

To produce one washer, a small compound die requires approximately

40 to 45 LBS. OF CRITICAL STEEL

THE HOVIS WAY

To make the same washer, one set of Interchangeable Parts for a Hovis ¾" Washer Die uses

ONLY 3 LBS. OF STEEL

Five simple, interchangeable parts are all the special tooling required to make a new size of washer by the Hovis method. The various interchangeable parts can be removed and replaced by the use of standard Hexagon Socket Screw Wrenches without dismantling the die in any way, the change being a matter of minutes. All these parts are held in by the Hovis Punch Retaining Mechanism. Naturally, the interests of economy and the victory program demand the use of Hovis Universal Washer Dies in today's production schedules.

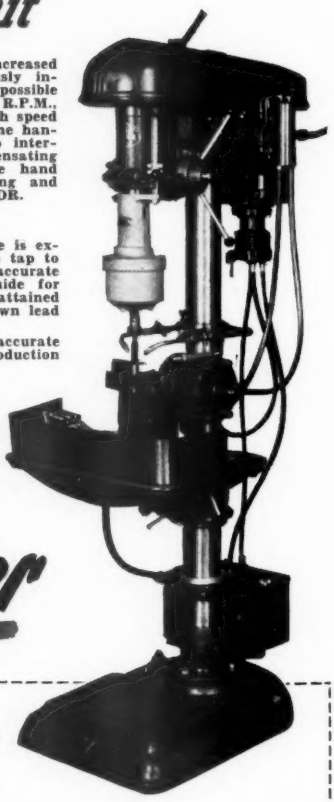
HOVIS SCREWLOCK COMPANY

8100 E. Nine Mile Road - Van Dyke, Michigan

Suburb of Detroit *Phone: Centerline 1575*

Increase your Tapping Output

with this New Unit



Procunier Universal Tapping Machines give increased output, more accurate tapping and tremendously increased tap life. The features that make this possible include: 1. Four speeds, ranging from 390 to 2050 R.P.M., efficiently handle jobs for which conventional high speed tapping machines are inadequate. 2. One machine handles tap sizes from No. 2 to ½" through two interchangeable heads. 3. Extra long Spiral Compensating Springs conveniently located, with wide range hand screw adjustments, maintain pre-set tap feeding and reversing pressure INDEPENDENT OF OPERATOR.

TAP ESTABLISHES ITS OWN LEAD!

The new Procunier Universal Tapping Machine is exclusively designed so that it actually allows the tap to establish its own lead. There is nothing more accurate than a precision ground thread tap as a guide for tapping — so maximum tapping efficiency is attained where an accurate tap is free to establish its own lead in cutting the thread.

This exclusive Procunier feature means more accurate tapping with every thread uniform, greater production with less spoiled work and less tap breakage.

SEND FOR CATALOG

giving full details, description and prices on the full line of Procunier Universal Tapping Machines, hand or foot operated, the complete line of Procunier Precision Tapping Heads to meet all needs and the new Tru-Grip Tap Holder. The Procunier Safety Chuck Company, 12-14 S. Clinton St., Chicago, Illinois.

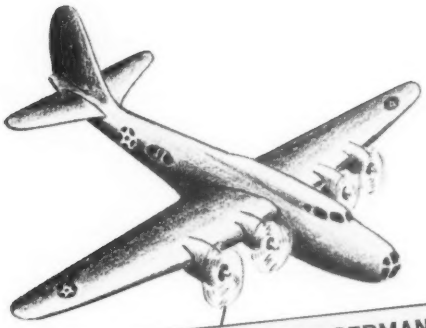
Procunier

PROCUNIER SAFETY CHUCK COMPANY
12-14 S. Clinton St., Chicago, Ill.

Send me bulletins on: ☐ High Speed Tapping Heads. ☐ Tru-Grip Tap Holders. ☐ Universal Tapping Machines.

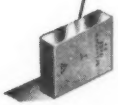
Name .....

Address ..... City ..... State.....



LONDON · · · FLYING FORTRESSES BOMB GERMANY AGAIN · · ·

. . . and they all took off from this tiny block



Planes like the American Flying Fortresses just don't happen—it requires the combined efforts of designers, engineers and all sorts of technical men to conceive and construct planes of this type.

Yes, it requires highly skilled men to put these flying fortresses into the air, but it also requires the production of thousands of precision parts by both small and large companies before these planes can be manufactured on a production basis.

These plants, scattered over the entire country, are pouring finished parts into the assembly plants in an ever-increasing stream. There inspired men are working day and night moulding them into the finest aircraft in the world. What makes all this possible? —The Gage Block—standard of measure and the controlling factor in the manufacture of interchangeable precision parts.

Thus it is only natural that such particular attention is being paid in the acquiring of new standards. Are they reliable—durable—of high quality? It is the reason that today leading precision manufacturers throughout the United States, Canada and Great Britain are specifying Dearborn Gage Company's chromium plated gage blocks—standards with longer wearing millionths. They are available in three degrees of accuracy namely:

W	**—OR "WORKING SETS"**	"W" accuracy is a guaranteed tolerance of ± .000008 inch per inch or fraction thereof, of gage.
I	**—OR "INSPECTION SETS"**	"I" accuracy is a guaranteed tolerance of ± .000004 inch per inch or fraction thereof, of gage.
L	**—OR "LABORATORY SETS"**	"L" accuracy is a guaranteed tolerance of ± .000002 inch per inch or fraction thereof, of gage.

For prices on sets or individual blocks write for our new catalog today. Deliveries can be made within a reasonable time.

ORIGINATORS OF CHROMIUM PLATED GAGE BLOCKS

DEARBORN GAGE COMPANY 22034 BEECH STREET DEARBORN, MICHIGAN

Are your gages inspected under temperature *Control?*

IN THE manufacture of gages, most companies insist that each operation performed is carefully inspected—but we at PERFEX go one step further by insisting that every gage we manufacture is inspected in our temperature controlled room to insure the utmost in precision. With the installation of one of the latest types of air conditioning units we are able to keep this room at a temperature that doesn't vary over 2 degrees, so that a temperature between 68° and 70° is maintained at all times. This temperature control plus a complete line of checking instruments, such as the newest type of amplifiers, checking wires, gage blocks, and a light wave micrometer that is accurate to 3 millionths of an inch, are some of the reasons why PERFEX makes better gages.

• • •

For complete information and prices wire or write us today.

Special Thread Length Gage

Special 4 Pitch Left-Hand Thread Gage

Full Whitworth Single End Thread Gage

ACCURACY PERFEX OUR CREED

PERFEX GAGE and TOOL CO.

3604 GAYLORD DETROIT, MICHIGAN

BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ **Production**
- **Adaptability**
- ★ **Fixture Saving**
- **Operation Saving**
- **Material Saving**
- **Fine Finish**
- **Flatness**
- ★ **Close Limits**

★ . . . . . *Especially valuable on jobs like the one illustrated.*

"PUT IT ON THE BLANCHARD"

Grinding cylinder bushings on Blanchard No. 18 Surface Grinder

THESE cylinder bushings, 3½ inches high by 3½ inches in diameter, are of extremely thin section, yet they are held securely on the Blanchard No. 18 magnetic chuck. These bushings are Gunite castings. .006" of stock is ground off both ends to limits of ±.0005" for size, and .0005" for parallelism. 50 pieces (100 surfaces) are ground per hour.

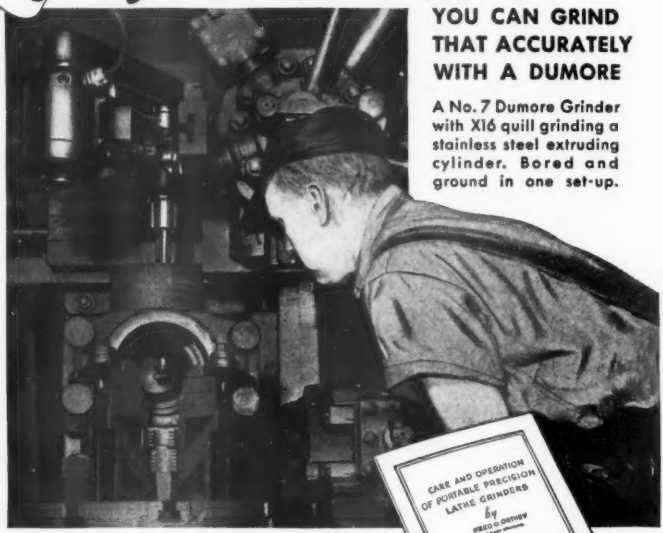
Multiple chucking and grinding on the Blanchard is the sure and economical way to machine parallel surfaces on parts such as these, also on collars, gear blanks, and washers.

The Blanchard Magnetic Chuck is so adaptable to holding a wide variety of work that it takes the place of many expensive fixtures that would be necessary on other types of machines.

The **BLANCHARD**
MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.

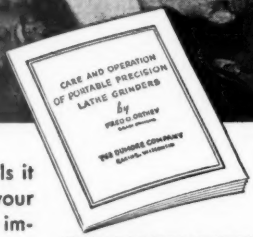
Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

1/28 the thickness of a Human Hair



YOU CAN GRIND THAT ACCURATELY WITH A DUMORE

A No. 7 Dumore Grinder with X16 quill grinding a stainless steel extruding cylinder. Bored and ground in one set-up.



WRITE FOR THIS HELPFUL INSTRUCTION BOOK ON PRECISION GRINDING

Maintenance of tools is a vital wartime necessity. For this reason, the Dumore Company now offers this practical handbook FREE if requested on your company letterhead. Regularly priced at 25 cents.

For superior military machines, and the tools it takes to make them, use Dumore Grinders on your lathes, planers, milling machines, and other important machine tools. When you can grind to .0001 of an inch . . . within 1/28 the thickness of a human hair . . . that's precision production. Dumore Grinders do more than that...they save man hours, material . . . even lives . . . by stepping up production schedules, reducing spoilage, turning out better work, more work in less time. Dumore Grinders also are noted for their versatility . . . they can be mounted in so many ways, so quickly, easily. What's more, they can handle a job from start to finish . . . from the first rough cut to the final finishing operation. Let Dumore engineers help you solve your war production problems, increase the productive capacity and efficiency of your present machines. . . . *SEE A DUMORE DISTRIBUTOR OR WRITE.*

THE DUMORE COMPANY, 372-L, Racine, Wis.

Dumore PRECISION Grinders

SAVE PRODUCTION TIME

with a

SHOPLIFTER

One man can handle heavy dies alone. Not necessary to stop other machines to get help.

MORE production per day from your machines if a Shoplifter is handy to do the heavy job of moving dies from storage racks to the press. In these times when maximum production of machines is of vital importance, much time and labor can be saved if the operator can handle the heavy work of changing dies without calling for help from other operators.

The Shoplifter is built for this job. Dependable and safe with a rated capacity of 500 lbs. (heavier machines up to 5000 lbs. can be furnished). Entire machine built of structural steel. Electrically welded throughout. Platform lifts 57" above floor and lowers to within 8¼" of floor. Overall height 72". Size of platform 24"x24" steel plate. Crank, up and down, hoist unit.

ECONOMY ENGINEERING CO.

2659 W. Van Buren St., Chicago

Price

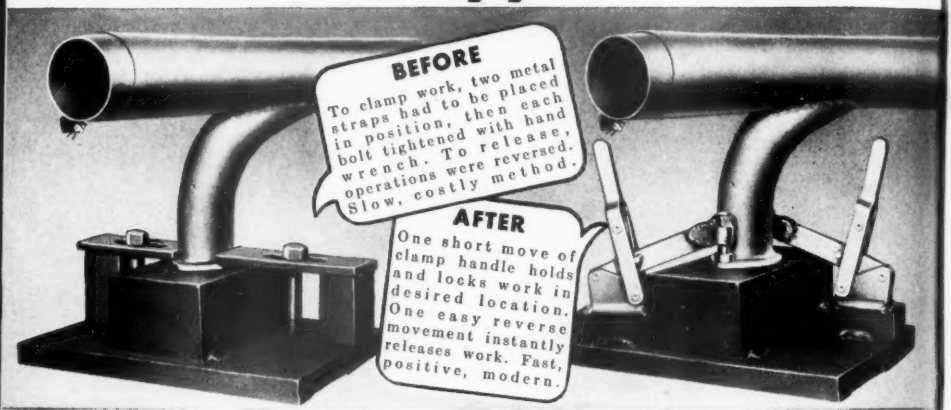
$147.50

IMMEDIATE DELIVERY

Production Increased over 350%

thru use of simple fixture equipped with

DE-STA-CO *Toggle* CLAMPS


BEFORE
To clamp work, two metal straps had to be placed in position, then each bolt tightened with hand wrench. To release, operations were reversed. Slow, costly method.
AFTER
One short move of clamp handle holds and locks work in desired location. One easy reverse movement instantly releases work. Fast, positive, modern.

This fixture built only for checking flatness of flange and parallelism of tube, yet since 100% inspection was required a low cost fixture was needed, and De-Sta-Co Toggle Clamps again filled the bill.

The advantage of using De-Sta-Co Clamps lies in your ability to build a simple or more complicated fixture for purposes of increasing production, for less cost and in shorter time. Also by use of a confining nest for piloting, the clamp will not close unless the part is in proper location, which prevents errors due to stray or interfering chips.

De-Sta-Co Toggle Clamps Bulletin No. 42, just off the press, illustrates many different types of fixtures, some of which may suggest to you how the part you need to clamp can best be held.

Send for your copy of "Bulletin No. 42"—it's free.

Below are illustrated but a few of the many models available.

No. 215
Horizontal Style
Light Duty

No. 220
Light Weight
Popular Model

No. 210
Straight Bar
Medium Heavy

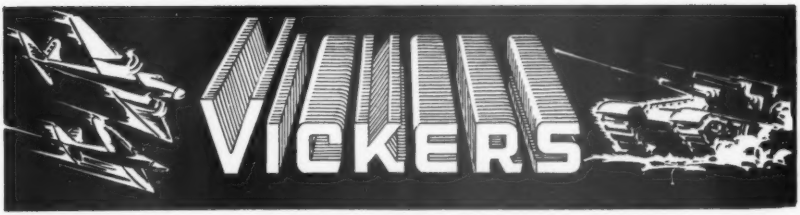
No. 250
Heavy Duty

No. 110-CO
Heavy Duty
Low, Straight Bar

★ ★ ★ ★ **DETROIT STAMPING CO.** ★ ★ ★ ★

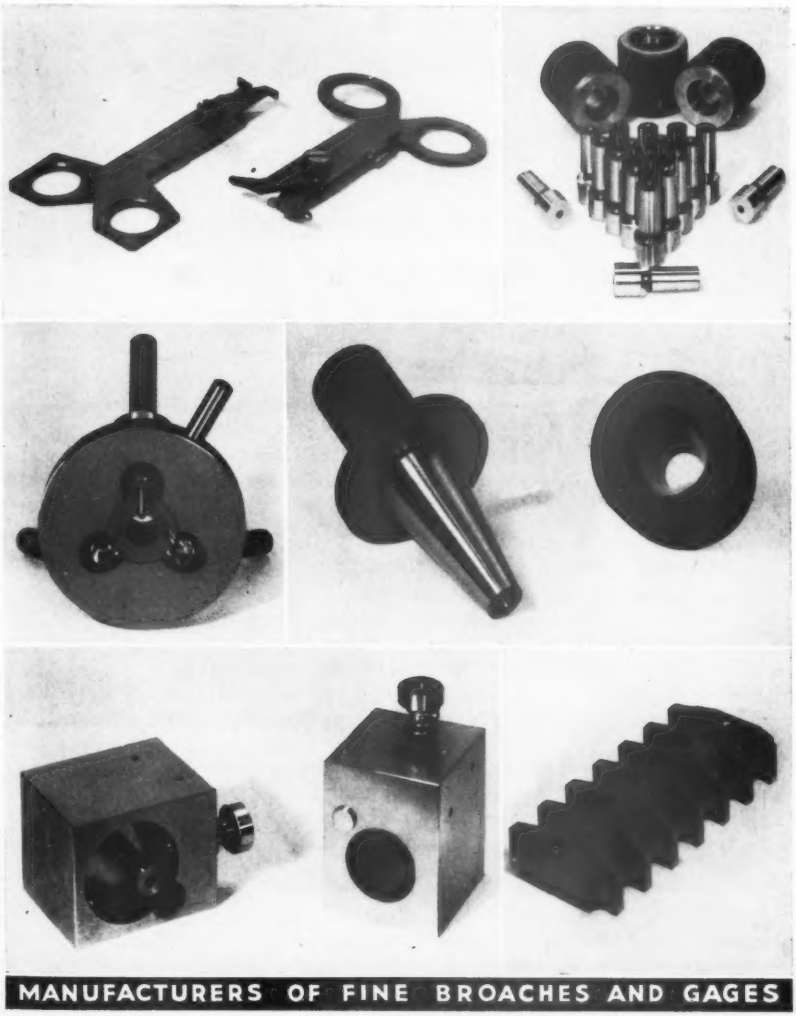
Established Over 25 Years

344 Midland Ave • Detroit, Mich.



BROACH & GAGE CO.

1009-15 Franklin St. Detroit, Mich.



MANUFACTURERS OF FINE BROACHES AND GAGES

Helping *other* Manufacturers in a pinch makes it easier for your Distributor to help *You!*

Have you ever benefitted by some resourceful Distributor's *borrowing* of tools or supplies that neither he nor you had in stock on a particular day?

Knowing his territory as he does, the Distributor usually knows what manufacturer has a temporary surplus of what—and can spare a supply until the stock can be replenished.

You *always* need your Industrial Distributor —not just as a telephone number or street address, but as Chief Headache Absorber for your Purchasing-Expediting Department.

Your Distributor is trained to give you a hand on Priorities, too.

Draw on his experience for obtaining the supplies you need. It certainly will be the exception if you don't meet men of your own measure—in fact we are sure they *will* be.

These same Mill Supply Houses have served for many years as this Company's Distributors of Cle-Forge High-Speed Drills and Peerless High-Speed Reamers throughout Industrial America.

Awarded May 22, 1942
Superseded July 13, 1942

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

30 READE ST. NEW YORK 9 NORTH JEFFERSON ST. CHICAGO 650 HOWARD ST. SAN FRANCISCO
6602 SECOND BLVD. DETROIT LONDON - E. P. BARRUS, LTD.- 20-26 31 UPPER THAMES ST.-E.C.4

ARMY E NAVY

Awarded August 8, 1942
★

"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

THE TOOL & DIE JOURNAL

NOVEMBER, 1942 VOLUME 8, NUMBER 8

Let's Finish the Job In '43

Letter from Washington

by

George J. Huebner

BATTLES won, eventually become wars won. Circumstances may affect the winning of a battle, but no one will dispute that the fighting force which goes into battle with superior equipment and more of it has the edge on the enemy. American tanks, planes, guns, ships and other material have quality. They are demonstrating it every day on the world's battle fronts. To Americans on the industrial front, this should bring great satisfaction. But quality is not enough. There must be ever more quantity, more of everything including the means of transport—ships of the sea and ships of the air.

American Industry must continue to step up its tempo. Outputs must grow bigger, with the same number of workers or even fewer. More inexperienced workers must be trained; women must be taught. Everywhere, idle machines must "get going".

Subcontracting must be broadened. No manufacturing operation or assembly should be delayed in one plant because of a shortage of equipment if similar facilities and workers are available in another plant. Every War Production Board field office is equipped to locate such alternate facilities.

The tooling industries are prepared to meet the increased demands of duplicate production lines. Product redesigning for simplification in manufacture, and sometimes changes in material specifications to relieve or overcome critical shortages, may be necessary. Our enemies have apparently gotten along without much that we still consider necessary. Are we less resourceful?

Our boys in foreign lands say: "Give us the planes, the ships, the guns and we'll do the fighting". Our allies—China, Russia, Britain—have demonstrated their willingness to sacrifice their men if we will help to equip them.

So let's get the job done. Let's devote the necessary thought and organizational effort to making *enough* of everything that is needed for our all-out world offensive and to getting it to our own and our allies' fighting forces.

Let's turn out so much of everything necessary to *blast* the outlaw nations that we will finish the job in '43.

Metalurgency

Facts about "the emergency that exists in the high alloy steel supply" and what Industry and Army Ordnance are doing about it.

Publication authorized by Major General L. H. Campbell, Jr., Chief of Ordnance, United States Army.

WORLD WAR II has been called a Production War and a Mechanized War, but basically it is an Alloy Steel War.

A Mechanized or Production War would not be possible were it not for alloy steels. Steel itself is a generic term and there are almost as many kinds of steels as there are machines. Every steel we have is a combination of iron and one or more other elements, each combination having specific qualities, such as hardness, toughness, elasticity, tensile strength, stretchability and machinability. For instance, armor plate must be hard enough to stop projectiles. Projectiles must be harder to pierce armor plate. Shell cases must be elastic to be easy to withdraw from the gun after firing and gun barrels must have the tensile strength to withstand the firing pressure. The pins that hold a tank track together must have high wearing qualities, but the steel used in our truck cabs and fenders must be soft enough to be formed between dies.

Metallurgists have given us steels with these characteristics and hundreds of others, by combining various ferro-alloys and other elements with iron and by devising ways and means of treating or working them. The most common of these added elements, aside from the ever-present carbon, are nickel, chromium, vanadium, molybdenum, manganese, and silicon. And, there's the rub!

Metalurgency Cause

In peacetime, steels using these metals, amounted to only about seven (7) percent of our total steel requirements. In war, the percentage is climbing to twenty (20) percent of the total. This, plus the fact that with the exception of molybdenum, of which this country has practically all of the world's ore deposits, we are dependent on imports for an appreciable percentage of our supply. Therefore, the metallurgists, who make it possible for us to create our modern war machines, see us faced with a "Metalurgency" that must be met if we are to reach our War Production goals. We simply could not build our war machine out of the same steels that we used

two years ago, because there isn't enough Nickel, Chromium, nor Molybdenum, etc., to put into them.

Nor are we building our war machine out of the same steels we used two years ago. If we were, we would have already hit a production ceiling. Ordnance metallurgists and engineers, industry metallurgists and engineers, both tackled this problem long months ago, and only a specialist would recognize hundreds of today's specifications as akin to those two years old.

Conservation Progress

Army Ordnance is the largest user of our steels, absorbing in its production about sixty-five (65) percent of the war tonnage. On part of 1942 production and 1943 projections, our armed forces have devised ways and means of saving 72,103,-055 pounds of Nickel; 18,313,452 pounds of Chromium; 1,647,870 pounds of Vanadium, with only a 1,131,216 pounds increase in the use of Molybdenum. Army Ordnance has saved 80% of the Nickel, 70% of the Chromium, 75% of the Vanadium, and has used up 88% of the extra Molybdenum.

This added war time demand has put a strain on Molybdenum mining and smelting facilities that they were not geared up to handle. Typical of this program to meet the Metalurgency is the accomplishment of the Tank Section. The Chart shows saving progress in the specifications of a medium tank. Similar charts could be drawn for other tanks and for hundreds of items in Small Arms, Ammunition, and Artillery.

The Metalurgency has been faced, is still being faced, and must be faced more realistically as the weeks pass. The Alloy Steel War is yet to be won, but the tide is turning.

Fluctuating Supply and Demand

There is no formula for meeting the Metalurgency except the generality, "Reduce the amount of Alloy Steels required for our War Production and do it fast!" The availability of scarce metals is not static. Our supplies are not always certain. The sinking of a ship, or the development of some new machine of war to meet or defeat the enemy, may put an unforeseen demand on our resources. For instance, Industry's and Ordnance's first effort to save Nickel and Chrome was to step up the use of Molybdenum steel. Now the problem of Molybdenum is in the forefront. Therefore, Ordnance and Industry have to so surround the multitude of problems that when the necessity arises, a shift can be made.

Safety Requirements Intensified

But, changing the specifications on a gun or a tank, or even on a projectile is a far more serious matter than changing them on civilian devices. Ordnance Material must protect the lives of our soldiers while being effective against the enemy. A gun barrel must be so built that a premature explosion will not shatter it and kill our own gun crew. A new steel for a helmet might even be stronger, but if it is magnetic it will deflect instruments and upset calculations. So it should be appreciated, when you judge the progress made and the serious Metalurgency that exists, that all of these savings must be accomplished without lowering the safety and performance requirements.

Special steels present a difficult prob-

lem. While no stone can be left unturned in experimenting with new and special steels, they cannot usually be considered unless production facilities exist in a number of different mills.

This means that every theory, every idea and every design must undergo tests, and in many cases problems have to be solved by the trial and error method. All this has to be done in absolute secrecy from the enemy.

The Integration Problem

This gigantic business of making war is far more complex than any single peacetime industry. In fact, it is obvious that all-out war has brought a great majority of our industries together on the single job. The primary task therefore has been to integrate all industries, just as many individual industries have been integrated for the mutual benefit of the individual companies.

The Automotive and other industries have patent pools, whereby after a period of time all manufacturers have the advantage of developments that will enable them to produce a better product at a lower cost. In effect, Army Ordnance has set up a patent and idea pool.

Today it is easier than ever before for one section of Ordnance to take advantage of the mechanical, electrical and metallurgical developments of the other. It is also easier for a manufacturer or engineer to make a contribution to many sections instead of just one.

It is this type of coordination that is meeting the Metalurgency and winning the Alloy Steel War.

How Conservation is Effected

We have said that there is no formula for cracking the Metalurgency, except to think, try, test, think and try again. It would require a full library on Engineering, Chemistry and Metallurgy to cover the wide ramifications of the subject. It is further unwise to divulge outside of Army and Navy circles, all of the intimate facts in connection with the developments taking place, and that must take place.

In the face of these facts, however, Army Ordnance recognizes that all-out war requires all of the brains, ingenuity and energy of this country. Therefore, this article will illustrate a variety of general procedures that have resulted in conservation of scarce materials, with the hope that they will serve to open up lines of thought and experimentation to many readers with resultant multiplication of the accomplishments already recorded.

National Emergency Steels

With a full knowledge of what was ahead, early in the conflict, a program to develop National Emergency Steels was inaugurated.

The American Iron & Steel Institute, The Society of Automotive Engineers, the War Production Board, Army Ordnance, and other branches of the service cooperated in incorporating, testing and cataloging series of steels including smaller quantities of the scarce ferro-alloys.

Some of these steels have been and still are in use. Others were the result of laboratory efforts. Still others became usable to replace high alloy steels because of new or improved production, treating or working processes.

One fairly common characteristic of National Emergency Steels, however, is that the ferro-alloys in them are largely provided by the alloy scrap that goes into the heat and therefore less virgin alloy metals are required. This reduces the strain on ore deposits, mining, smelting and transportation.

Army Ordnance has adopted and used these lower alloy steels in hundreds of applications. They have been incorporated into Army specifications and together with several other carbon and alloy steels are known as W. D. (War Department) Steels.

This W. D. Classification has been established and is incorporated on all of the million-odd Ordnance drawings to give Army Ordnance the necessary control over specifications, particularly the multitude of changes that occur as alloy supplies and redesigns require them.

This system simplifies the training and work of Ordnance Inspectors by giving them standardized acceptable and non-acceptable limits.

Examples of this substitution and accompanying saving cover a variety of items.

A prime example of ferro-alloy conservation is the 90 mm. Anti-Aircraft Gun. Several parts were changed to low alloy N. E. type Steels and others even to plain Carbon Steel. These changes will make an accumulative saving in 1943 of 300,000 pounds of Nickel.

In the operating rod handle of the M-1 rifle, W. D. 8750 (N. E. 8749) Steel was substituted for W. D. 6150 Chrome Vanadium Steel with a saving which in 1943 will amount to well over 12,000 pounds of Chromium and more than 4,000 pounds of Vanadium.

The trigger guard and follower rod body of the M-1 U. S. rifle .30 cal. were formerly made from 6150 Chrome Vanadium Steel. Now that it has been changed to W. D. 4050 Carbon Molybdenum Steel, approximately 40,000 pounds of Chromium and over 3,000 pounds of Vanadium will be saved in 1943.

A change in the type of steel in many parts of the Calibre .30 M1919A4 Browning Machine Gun is now in effect and in 1943 will save 460,000 lbs. of Nickel.

Tank track pins have to take the wear and strain of linking Tank Track Shoes together. W. D. 8750 Steel (N. E. 8749) is now doing the job in place of W. D. 3250 Nickel Chrome Steel and quenching difficulties have been eliminated in addition to the Nickel and Chromium saved.

An example of how a simple change to a steel casting from a forging, before machining, resulted in a tremendous saving. By using a sand core to obtain certain contours, the weight of a breech ring before machining was reduced, machining time was saved, cost of the rough part was cut to one-fourth, and every month we are saving 30 Tons of Nickel and 20 Tons of Chromium.

Our stepped-up tank building program and the increased use of welding has boosted the tonnage of welding rods required. However, here again the adoption of another type of steel will save 4 million pounds of Nickel and 2 million pounds of Chromium in 1943.

New Manufacturing Methods

Here are two new ways of making gun or cannon barrels that are helping to meet the Metalurgency. They are the Method "X" which cannot be revealed and the Centrifugal Casting method as contrasted with the method whereby a solid forging is machined inside and out.

Only about ⅓ of the ingot weight is required by Method "X". The amount of machining and scrap is also reduced materially.

While these two facts show an obvious saving in Chromium, Vanadium, and Nickel required for ingots, there is a further saving made possible by this process. Because of the hardening effect of hot working on thinner sections, a lower alloy steel may be used. Further reductions by the use of a low alloy N. E. Steel are being tested.

Again rough metal weight and consequent alloy weight is saved by the Centrifugal Casting Method because the casting is hollow and nearer to final shape.

A saving of 360 tons of Nickel and 6 tons of Vanadium per month is now in effect, because the nature of the process, plus cold working, provides the strength formerly given by the greater quantities of ferro-alloys.

This same centrifugal casting method of forming the rough shape is used to save scarce ferro-alloys in many other war parts. For instance, there are the sprockets used in the Tank driving mechanism. Since centrifugal casting produces a better structure for this purpose and places the hardest metal near the circumference where the wear is greatest, a lower alloy steel is used.

Heat Treating

The art of developing desired physical characteristics in metals by heat treating has become highly developed, and in Army Ordnance it is probably responsible for more conservation of scarce ferro-alloys than any one other thing.

Heat treating has been touched on under other headings, but the field is so

broad that it deserves a chapter all of its own.

To illustrate the possibilities, here is a "touch and go" pair of illustrations—armor plate and armor piercing projectiles.

Armor plate must stand up under the pounding that enemy armor piercing shells will subject it to. It must be hard and tough. For these reasons it has been one of the heavy consumers of hardening and toughening alloys. But engineers and metallurgists have so refined heat treating processes that without any reduction in ballistic requirements, on current production every month, Army Ordnance is saving 520 Tons of Nickel, 100 Tons of Chromium and 16 Tons of Vanadium.

Just across the hall is the division that must produce the projectiles which will pierce the enemy armor plate. These projectiles must have what it takes to pierce and plow through the best that is erected against them, and then do the maximum damage on the other side. That puts a real job up to the metallurgist. But here again he has faced the Metalurgency and in the short span of three months, on two sizes alone, the monthly savings are 90 Tons of Nickel and 20 Tons of Chromium, and they hit even harder and more effectively.

Induction heat treatment has been used with major success by the Automotive Industry and therefore it is logical to see this process credited with a substantial share of the conservation record in the manufacture of the automobile's gruesome cousin, the tank. Our Chromium and Molybdenum supplies are the chief beneficiaries of Induction Heat Treatment in a multitude of Tank parts.

Redesign

Redesign affects many comparatively small parts, millions of which are required. But in addition to saving hundreds of tons of material and critical machine hours, redesign is saving critical ferro-alloys by making possible the use of low alloy or carbon steels.

In literally millions of hand to hand combats, the lives of soldiers, sailors and marines depend on the qualities of that "persuader" on the gun end called the Bayonet. It must be strong and tough. It must go where it is sent and come back in one piece.

In the program of improvement the designer, with an eye to conservation, found that when a certain section was made slightly heavier, and another part was changed to permit higher heat treating, a saving of 10,000 lbs. of Chromium could be chalked up in one year on this "Tremendous Trifle" by using W. D. 1080 Carbon Steel in place of W. D. 5090 Special High Carbon Chrome Steel. This new steel in a soldier's hands is even a little colder than before.

In general, making a weapon heavier is undesirable, and is not conservation, but when the added weight is needed for strength and is small, and the saving of precious alloys is great, it is a happy combination. So when the shotgun barrel was thickened from .040 to .083 to provide sidewall thickness for tapping to attach a device, it permitted a change from Molybdenum Steel to low carbon steel.

This stationary Gear Carrier, a small part, is another "Tremendous Trifle" where redesign contributed both to a saving in machine hours and critical ferro-alloys. It was formerly machined from solid stainless steel. Now it is stamped out of carbon steel and cadmium plated.

Review of Specifications

Curiosity is a great attribute in a conservation program, but in the rush of war it is hard to find time to indulge in it.

Scarce ferro-alloys are being saved daily by the mere review of specifications to see what can be saved, where it can be saved, how it can be saved, and who can save it.

This curiosity has resulted in the saving of 600 lbs. of Chromium per month in the

(Continued on Page 127)

Modern Milling Fixture Design

This article is the eleventh in a series describing and illustrating improved milling fixture designs for speeding milling operations. Faster milling increases production of vital gun, tank and plane parts.

BODY designs for many types of milling fixtures can be "built-up" by welding together commercial sizes of cold rolled steel sections into a unit. This procedure saves much time and expense as compared with the alternative method of making a wood pattern, a cast iron casting and then machining its many working surfaces.

Figure 60 shows a case in which two upright blocks, C and D, are welded on base plate E to make the complete body for a milling fixture. The parts used are all standard sections of cold rolled steel and only the ends of their lengths require machining. Sometimes only one end needs finishing and in other cases neither end.

For welding the uprights on the base, cheap locating fixtures are utilized to position the parts. C-clamps are employed for positively holding the uprights while welding. Welded together jig and fixture bodies avoid the necessity of assembling the parts with screws and dowel pins. It saves time and unnecessary expense in producing critical parts used in war production. Furthermore, welded together tools also suggest that many of the products of tools can be joined by welding and with the same excellent advantages. This is particularly true of drawn and formed parts made in press tools. In welded together parts the weld is stronger than the materials of which the parts are made.

Double Action Clamps

The milling fixture shown in Fig. 60 is designed to hold a forged piece of work which is shown by the heavily dotted lines. The piece, an important part of a bombing plane accessory, is to be mill finished across its base. This fixture is designed to take two different sizes of forged pieces, as indicated by dimension *B* in Fig. 61.

The important feature in this fixture is the design of thrust clamp *F*. The rounded left end of this clamp fits (sliding) within a channel and the 30° angle

by C. W. Hinman
Designing Engineer

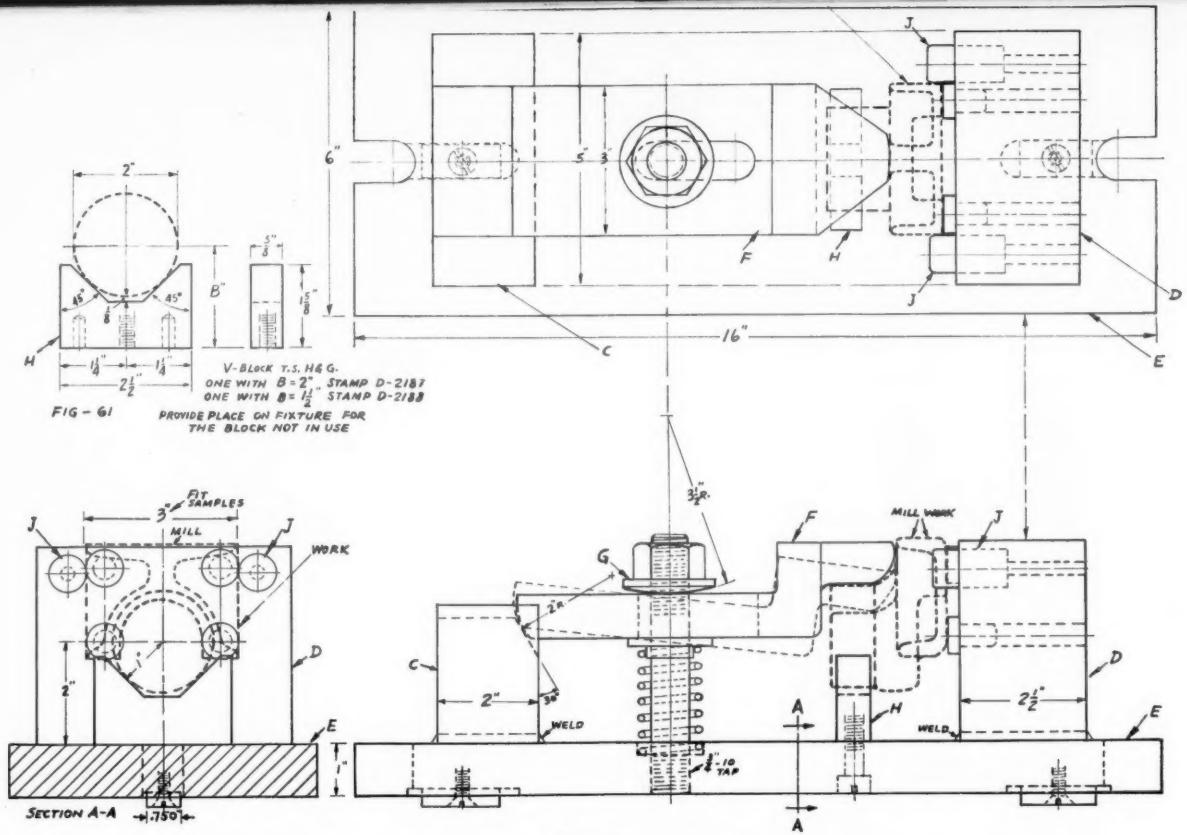


Fig. 60

Fig. 60 — An assembled fixture used on a milling machine to clamp the work simultaneously in two different directions.
Fig. 61 — Showing V-block design and dimensions for centering work in the fixture, Fig. 60.

cut in block *C*. When the clamping nut over the spherically faced washer *G* is tightened, the clamp immediately has two combined actions—it clamps *down* on the work and is moved *forward* toward the right. These movements simultaneously secure the workpiece in two different directions. The same clamp is designed to function when holding both sizes of the work, as indicated by the dotted position of the clamp.

The cylindrical part on the work lies centered in V-block *H*, detailed in Fig. 61. The lateral position of the work is confined between two gage pins *J*, shown in block *D*. The rear surface of the work, which has previously been finished in a similar milling fixture, rests against four hardened buttons, also shown in block *D*. While the work is rigidly held in all directions against the thrusts of the cut, ample open spaces provide room for clearing chips.

The cutter used for this job is a shell-end mill attached to a tapered shank and held in the spindle of a vertical head milling machine. In operation this style cutter has a tendency to hold down a light piece of work, such as this one.

Clamping Flat Work, Channels and Boxes

The foregoing principles of clamping can be expanded into several other practical designs for holding down a variety of work shapes for milling. One application of these principles, used for securing short and long rectangular sections, or channel and box shapes in milling fixtures, is shown in Fig. 62.

In the cross sectional view of this milling fixture, *K* represents two angularly nosed clamps having serrated gripping faces which contact both sides of the work. These clamps are opposed to one another. When the nuts are tightened the serrated faces on the clamps will each advance in two different directions, *down* and *forward*, and they will positively carry the work into contact with gaging surfaces *L* and *M* in the fixture. However, if the work is a channel section as shown, the width between the insides of the channel walls will vary in different pieces. These variations may be ⅛″ or more but can be taken care

(Continued on Page 148)

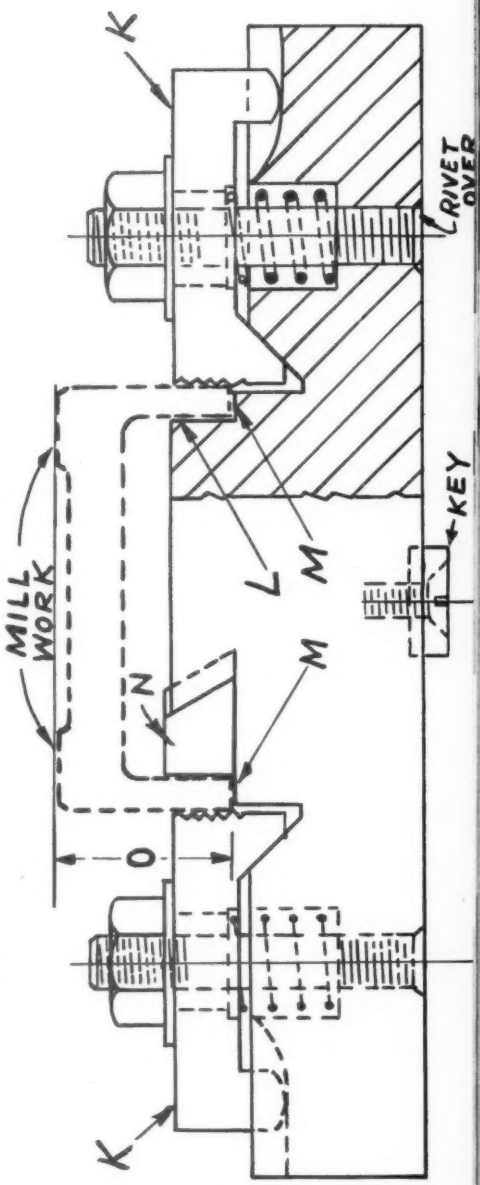


Fig. 62 — Cross section of a fixture used for clamping flat work or channels and box shapes of work for milling.

Surface Finish Inspection

This article continues a series on gage use and concludes the discussion on standards of surface measurement.

IN a previous issue, the principles of the Surface Analyzer for the inspection of surface finish were described. The top illustration on the opposite page shows a piston pin in place on a V-block, being checked in what can be considered a standard setup. It is quite conceivable, however, that a part might be encountered carrying a flange on each end, which would prevent the tracer point contacting the center of the pin when the pickup arm is in a horizontal position. Such a condition is encountered when attempting to check the throws of a standard crankshaft.

Under those conditions, the pickup arm is set at right angles to the drive head, as shown in Fig. 9. The motion of the pickup arm is always in a direction parallel with the center line of the drive head so that in the standard setup, the motion is also parallel with the center line of the pickup arm. However, when the pickup arm is set to a right angle position, as shown in Fig. 9, the motion then becomes *perpendicular* to the center line of the pickup arm.

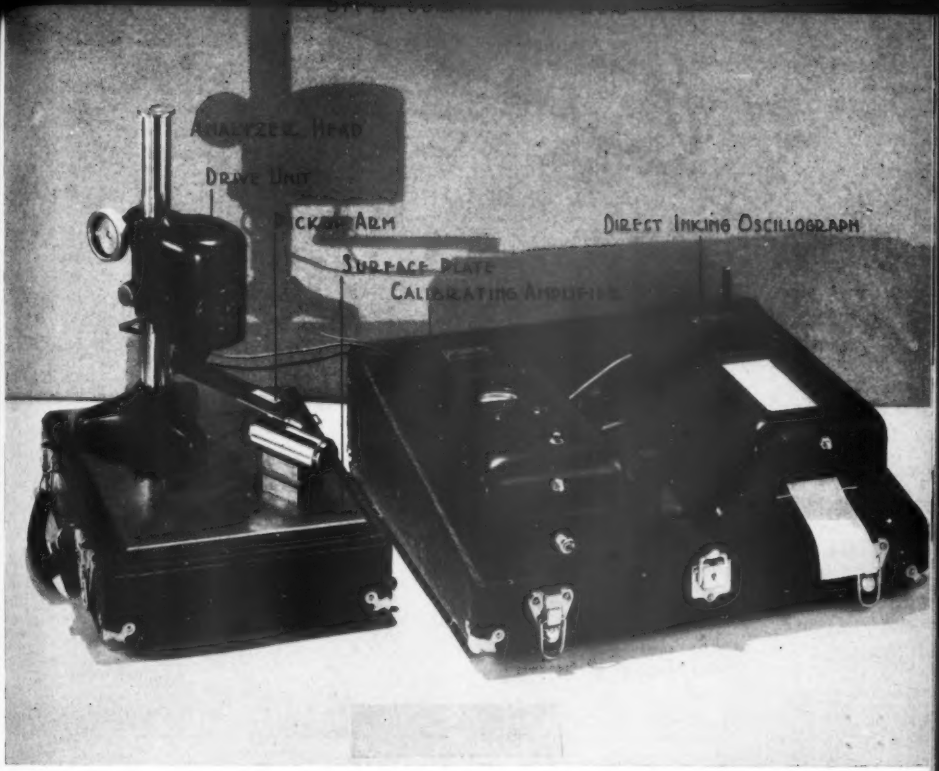
The approximate diameter of the advance finger is $\frac{3}{16}$". Thus, allowing for a $\frac{1}{16}$" motion, it becomes possible to check between flanges which are ¼" or greater apart.

Under these conditions, the chart obtained from any given finish will show up exactly the same as though the arm motion were parallel with, instead of perpendicular to, the arm itself. An interesting development of the pickup arm came with the demand for a means of checking the finish on the flanks of threads and thread gages.

Figure 10 shows a pickup arm for this purpose. It will be noted that, whereas the standard pickup arm carries the tracer point in a vertical position, this special arm carries the tracer point at a forward inclined angle. Also, the angle of the cone on the tracer point is lapped to 60° included, rather than 90° included. However, the radius of the end of the tracer point remains .0005", the same as the standard tracer point.

Figure 11 shows a special fixture designed and built by the engineers of Wright Field at Dayton, Ohio, for supporting male thread gages while using the special pickup arm shown in Fig. 9. It will be noted that there is adjustment in a plane parallel with the axis of the thread gage. This is for the purpose of

By H. S. Kartsher
The Brush Development Co.



bringing any given thread flank to a level corresponding with the top surface of the fixture, thus making a continuous plane of the thread flank and the top surface. The tracer point in this case is approximately $\frac{3}{16}$" in advance of the positioning shoe which forms the reference level.

In the illustration, the positioning shoe is resting upon the lapped top surface of the holding fixture, whereas the tracer point is resting upon the flank of the thread being inspected. It is quite possible that in the case of fine threads, the $\frac{1}{16}$" motion of the pickup arm will be greater than the depth of the thread being checked. However, there is a decided break in the chart which indicates the point where the tracer point has left the thread and rides on the top surface of the fixture. Thus, the section of chart in which the inspector is interested stands out very clearly as being the surface of the thread. No standards have been set, as yet, on the finish of thread gage flanks, but it is understood that they will be available in the near future.

Another interesting development of a special pickup came with the conviction of certain manufacturers of cutting tools

Fig. 9 — Drive motion at right angles to pickup arm.

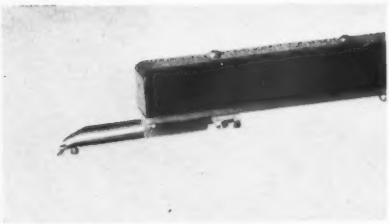


Fig. 10 — Pickup arm for thread flanks.

that the life of a cutting edge would be materially increased in some proportion to the degree of finish of the cutting edge. It will be apparent that even with a $\frac{1}{16}$" traverse it would be extremely difficult to line up the motion of the pickup so accurately with the cutting edge that the cone point of the tracer would remain in the same relation to the cutting edge. For that reason, the special pickup shown in Fig. 12 has been designed.

This tracer point takes the form of a chisel with the standard .0005" radius and spans the cutting edge under inspection. When this type of tracer point is used, the positioning shoe is always made with a larger radius than the standard positioning shoe, to again simplify the setup. This particular type of pickup is also used for the surface inspection of fine wire. No data is available as yet on the experiments, but they could be the basis for some very enlightening information if some of our cutting tool engineers, or advanced engineering students, had the time available. Other special purpose pickups are available for deep holes, small slots, etc., but are purely for unusual cases.

There is, however, an extension arm available for the standard pickup, by means of which cylinder bores as deep as 12" may be inspected. In our previous issue, the question of secondary "wave" was mentioned.

Figure 13 illustrates a chart taken from a surface showing both "roughness" and "wave". It will be noted, however, that the pitch of the secondary wave is only a few thousandths. In this case, the $\frac{3}{32}$" radius of the standard positioning shoe will span the pitch of the wave and still remain on a constant level. Waviness of greater pitch, such as might be found in a turned surface, cannot, at the present stage of development, be checked with any degree of accuracy.

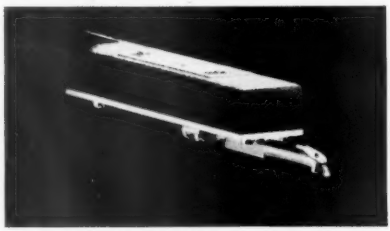


Fig. 12 — Pickup arm (special stylus) for knife edges and wire.

Many engineering drawings are now being issued, carrying the specification for surface finish in terms of "RMS Average Micro-Inches." It must be kept in mind that the charts of the surface analyzer show the deflections of the tracer point in terms of *actual* micro-inches and not "RMS Average" micro-inches. It is assumed that our readers are acquainted with the meaning of "RMS Micro-Inches." If not, they are referred to the report of the Committee on Surface Finish, B-46, under the procedure of the Society of American Engineers and the American Society of Mechanical Engineers. However, two charts are shown in Figs. 14 and 15, which illustrate the limitations of

(Continued on Page 137)

Fig. 11 — Fixture used by Wright Field for thread gages.

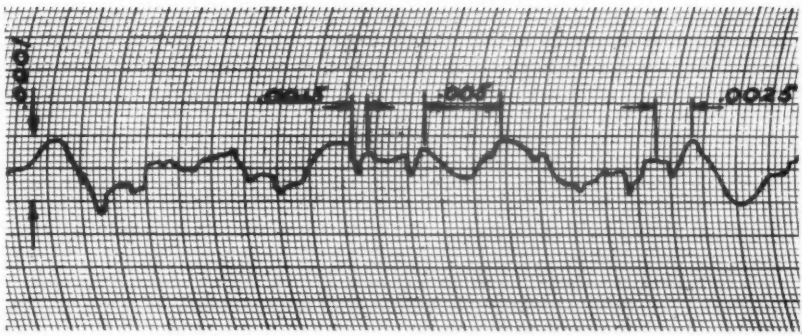


Fig. 13 — Surface analyzer chart of surface having a short "wave".

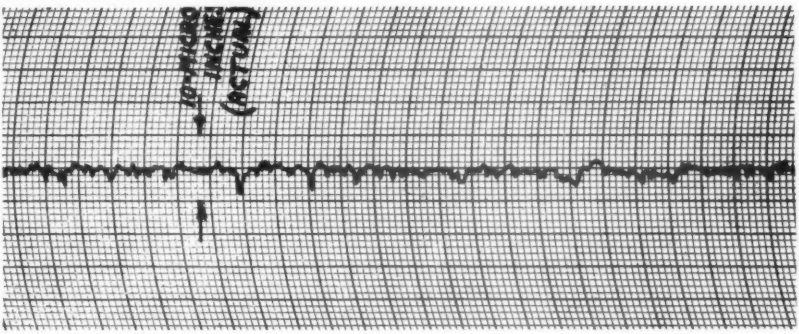
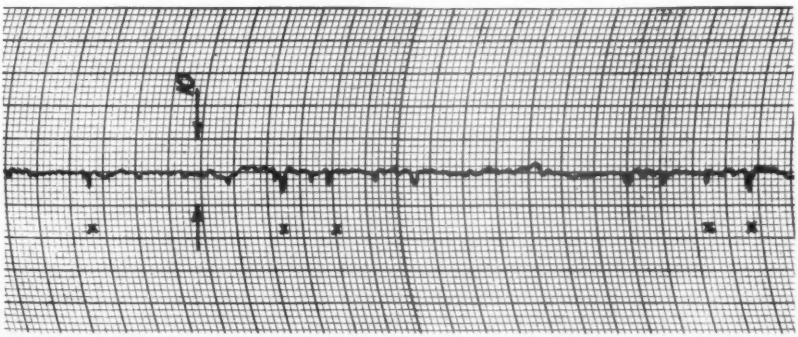


Fig. 14 — Partially lapped surface (.39 RMS). Many grinding marks still visible.

Fig. 15 — Multi-motion lapped surface (.35 RMS). Note a few deep scratches.



Getting the Most from Your Broaches

The WPB lists as critical broaching tools. Every precaution should be made to prolong their life. Excellent suggestions for use and care are described in this article.

SUCCESS in broach use involves a number of factors which are completely independent of broach design and selection. Often one of these factors is overlooked, with the result that broach life is shortened; production is lower than anticipated; and finish, dimensions and accuracy are impaired.

Broach Selection

Actually a broach is one of the most carefully and precisely made cutting tools used in modern production. The dimensions, shape, spacing and other elements involved must be exactly right for every tooth of the unit. The increase in diameter or contour of the individual teeth must be such that each tooth does its proper share of work on the part for which it is to be used. Hence the length of cut, the material, the size of hole or surface area must be known before the length of the broach or the capacity of the broaching machine can be specified. Conversely if a broach is to be used in a machine already in service, necessary calculations must be made to determine if all the metal can be removed in one pass or several; if the capacity is sufficient; if the proper finish can be obtained; etc. Unless these factors are known and considered, the quality and accuracy of the result may be less satisfactory than when every element of the operation is thoroughly understood.

Even when these factors in design and application are fully known there remain those elements influenced by broach use, which may be even more important than proper broach selection in achieving maximum life and performance. Yet these factors are sometimes lost sight of in the rush to get into full production in the present emergency. Nothing is gained by being hasty if the setup fails to give the necessary production or quality of work.

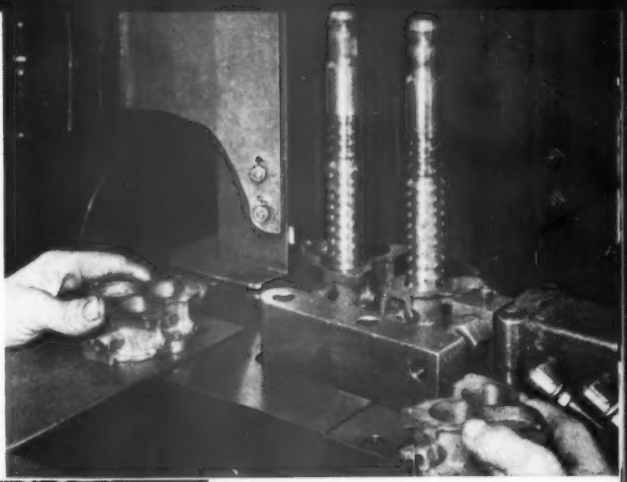
Simplicity of Correct "Broaching"

It is the simplicity of the broaching operation that sometimes causes difficulty. The part is quickly mounted in a simple or easily operated fixture. The pass is rapidly made. After the stroke is completed the work is removed and the broach returned to initial position. Little experience is required for these operations.

(Continued on Page 132)

Harry Gotberg
Chief Engineer
Colonial Broach Company

Fig. 1 — Each broach in Colonial Pull Down machine finishes holes of the same throttle body to eliminate variations in size between the two holes. This obtains a more accurate fit for the throttles and more uniform carburetion.



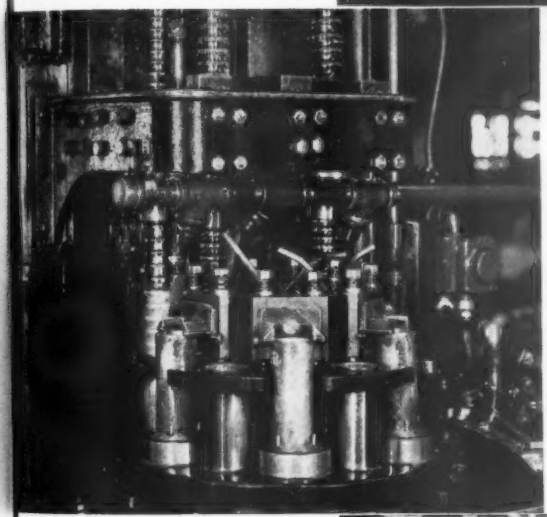
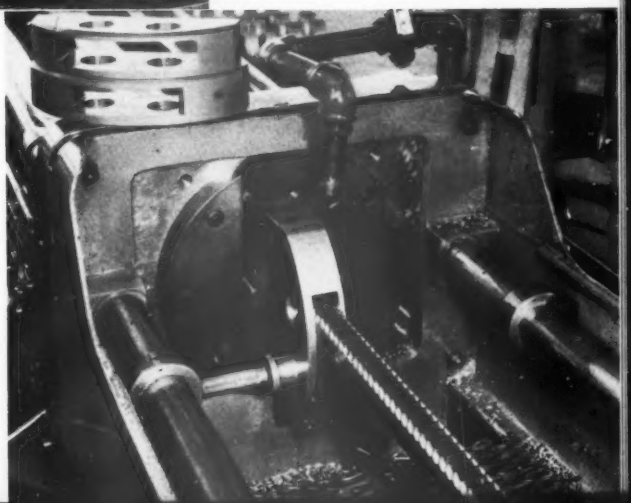


Fig. 2 — Broaching internal involute splines on propeller shaft ends at Universal Products Company, Detroit. Three hardened and precision ground broaches successively rough cut the hole, semi-finish and finish the splines on broaching machine equipped with a rotary table as shown. Accuracy of the splines is such that zero backlash is obtained between the propeller shaft yoke and shaft end.

Fig. 3 — Slotting aircraft engine counter weights on 25 ton, 72″ stroke Colonial universal horizontal broaching machine. Approximately .5″ depth of metal over width of .787″ is removed per pass on each side of slot.



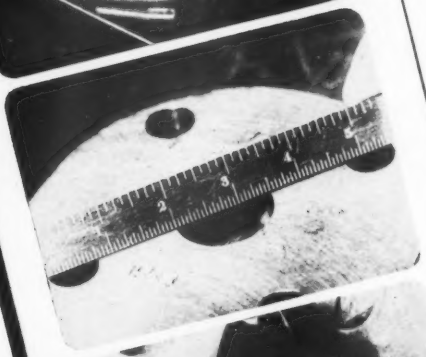
Drilling and Tapping Cast Steel

United States Office of Education film
produced by Emerson Yorke Studio

Safety, cleanliness and accuracy are three fundamental factors in all machine shop work. The careful operator swings the arm out of the way while cleaning chips from the table.

Operator files burrs from surface of work table.

A table near the machine contains drills, taps, jigs, etc. Each tool in its place speeds production.



The right jig for the job is checked by measuring the diameter and the number of holes of the bolt circle. Jigs are used to insure accuracy and increased production.

A good set-up is half the job. The wooden heel-blocks must be level with the top surface of the jig. Otherwise, the clamps may throw the jig out of place when pulled down hard.

Training new men for precision work in tool rooms or on the production line is, today, of major importance. Visual training using motion pictures has proven so successful that the U.S. Office of Education has produced a series of training films for machine operators.

This film shows the technique used when drilling and tapping blind holes in cast steel on a radial drill. The series of still pictures shown here were taken from this film and will give an idea of their value for training purposes.

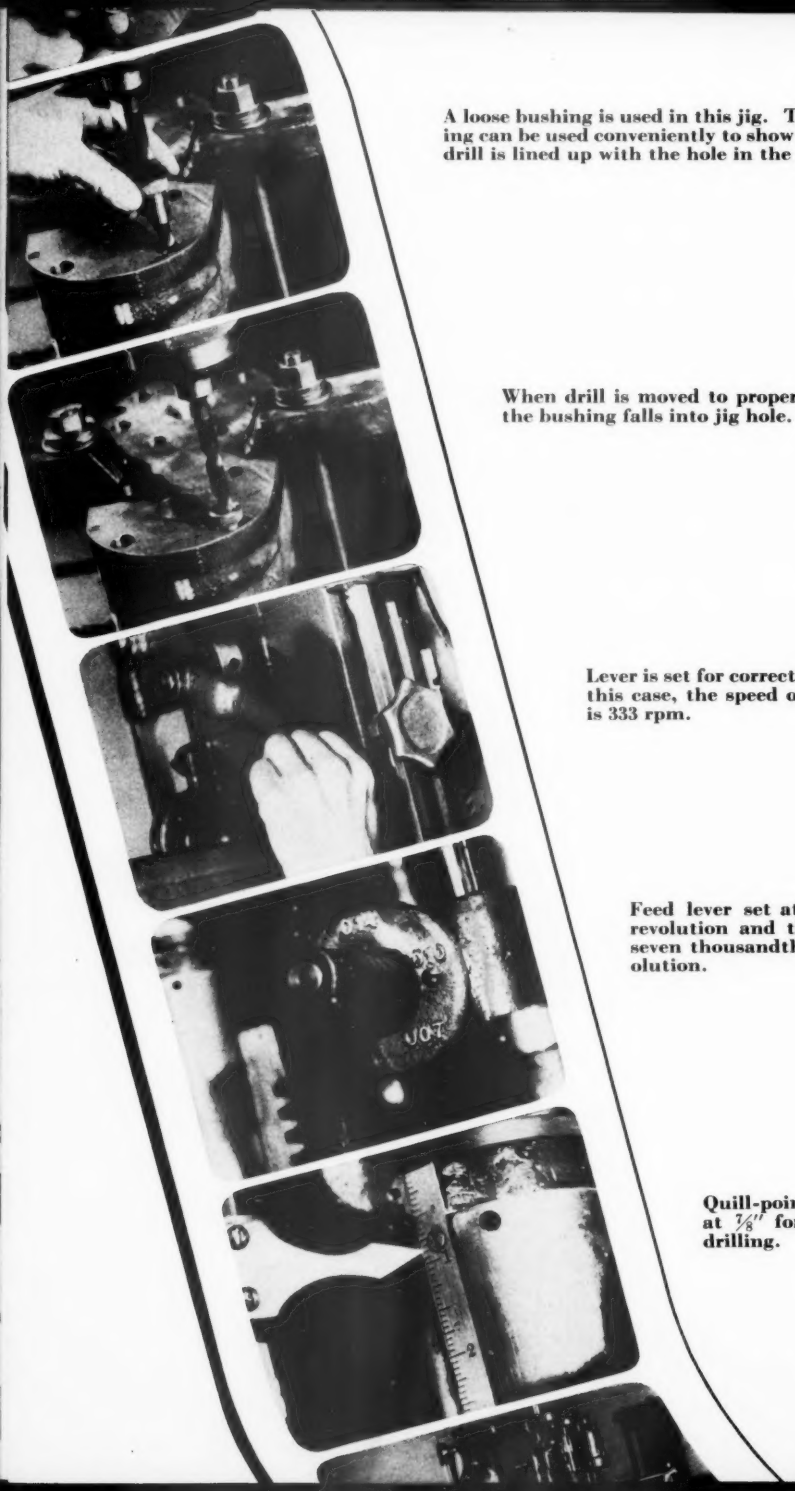
The center marks at each end of the jig and on the sides must line up with the reference marks on the piece.

Operator tightens bolts and moves drill arm over the work. He loosens arm clamps, otherwise serious damage to the machine might result.

To insert the chuck in the spindle, the tang is lined up on the tapered shank.

The size of the tap drill is important and should be obtained from a table of tap drill sizes. When drilling tap holes in tough metals, it is often necessary to use a drill 1/64th larger than the size shown on the table.

Operator moves drill head to left to align drill over first hole of jig.



A loose bushing is used in this jig. This bushing can be used conveniently to show when the drill is lined up with the hole in the jig.

When drill is moved to proper position, the bushing falls into jig hole.

Lever is set for correct speed. In this case, the speed of the drill is 333 rpm.

Feed lever set at .007″ per revolution and the feed is seven thousandths per revolution.

Quill-pointer is set at 1/8″ for depth of drilling.

Operator brings up drill and bushing — carefully removes bushing from drill.

Operator engages feed clutch and feeds manually — then engages power (automatic) feed. The competent operator always feeds the drill to the work slowly when starting a hole.

Drill removes large chips.

Operator removes drill from hole — loosens head clamp — moves head to left for second hole.

The piece has now been completely drilled. Jig is removed for tapping operation.

Each hole must be carefully cleared of chips. This is commonly done with a piece of magnetized steel kept for the purpose.

Operator inserts tap in tap holder and places into chuck.

Showing action of tap as demonstrated in lucite.

As the cutting progresses, the metal builds up, thus putting additional load on the tap. The load is released by turning the tap half a turn backward. This cuts off the accumulated metal and allows the tapping to proceed.

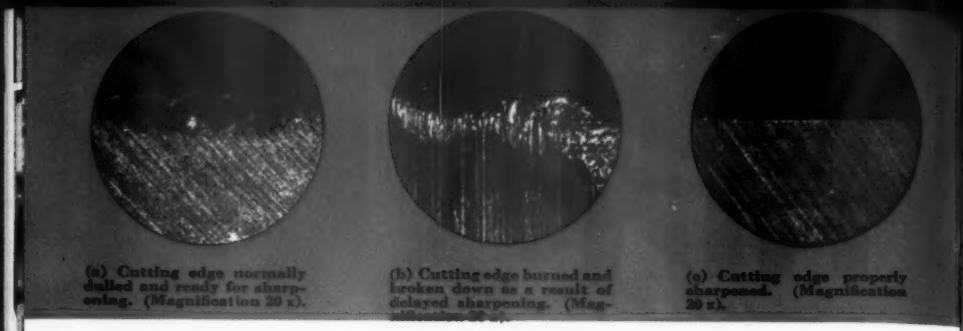
Completed drilled and tapped cast steel part.

TRAINING *for Victory*

EDITORS: DON E. ROOT CHARLES H. HAYNES

GRINDING TECHNIQUE

Training new workers in the efficient operation of machines and tools and up-grading operators to their maximum usefulness is a tremendous program. The TOOL & DIE JOURNAL is cooperating by issuing a series of educational articles on machining techniques. Reprints of this first article on grinding are available to all departments and operators responsible for this important activity in the production of war equipment.



(a) Cutting edge normally dulled and ready for sharpening. (Magnification 20 x).

(b) Cutting edge burned and broken down as a result of delayed sharpening. (Mag-

(c) Cutting edge properly sharpened. (Magnification 20 x).

Fig. 1

MEN in war production plants large or small doing precision work of any kind will profit materially by a better understanding of grinding wheels and grinding action—where each type and each structure can be used to best advantage, what can be changed in the wheel itself to bring about a desired result and what changes can be made in the operating conditions to turn out better work more rapidly.

More than a knowledge of the material to be ground is needed to enable one to properly select the grinding wheel for a given job. A complete analysis of the conditions surrounding a given grinding operation is necessary before the selection of the proper grinding wheel can be made. A knowledge also of the fundamental difference between the many wheels available is a prerequisite for obtaining satisfactory results.

Types of Abrasives

The most commonly used abrasives can be divided into two groups, aluminum oxide and silicon carbide.

The aluminum oxide abrasives and the silicon carbide abrasives are products of the electric furnace. The grains of silicon carbide are considerably harder than those of aluminum oxide and more brittle in nature. The grains of aluminum oxide, while not as hard, are tougher and therefore do not fracture as readily. When grinding steels and materials of high tensile strength (over 50,000 psi) aluminum oxide abrasives are employed. Included in this group of high tensile strength materials are carbide steels, high speed steels, tough alloys, Stellite, malleable iron and hard bronze.

Low tensile materials of a hard or brittle nature are usually more effectively and economically ground with silicon carbide abrasives. Gray or chilled iron, brass and soft bronze, aluminum and cemented carbides are included in this group.

Bond of the Wheels

There are five different processes of bonding grinding wheels—vitrified, silicate, resinoid, rubber and shellac. Each type of bond imparts distinct characteristics to the grinding action of the wheel.

The majority of grinding wheels are made by the vitrified process. This process consists esentially of mixing the abrasive grain with the correct amount of a mixture of clays of predetermined characteristics. Although generally limited in operating speed to 6,500 sfpm, vitrified wheels have an exceptionally free and cool cutting action without sacrifices of wheel life. These properties make them particularly desirable for tool and cutter grinding.

Silicate bond permits the release of abrasive grains more readily than in vitrified bonded wheels. They are used primarily for grinding edge tools and for any operation where there is a broad area of contact or where the heat generated in grinding must be kept down to a minimum. In the tool room they are

used on the large wet tool grinders for sharpening lathe and planer tools. They should *not* be used for rough grinding.

Resinoid is a phenolic resin, a synthetic organic compound. When used as a bonding material it makes a porous structure wheel capable of cool cutting and rapid stock removal. They are designed to operate at 9,500 sfpm on swing frame and floor stand grinders used in the snagging of castings and finish grinding. Resinoid bonded wheels have been successfully applied to the grinding of large milling cutters. For this work they are operated at normal machine speeds. Resinoid wheels are operated at 16,000 sfpm for cutting off various types of materials.

Minimum thickness for safe operation at high speeds in cut-off operations

12″	diameter—	$\frac{3}{32}$″	thickness
14″	"	—$\frac{3}{32}$″	"
16″	"	—⅛″	"
18″	"	—⅛″	"

Rubber bonded grinding wheels are used chiefly where a good finish is required. The rubber softens under the heat of grinding and acts as a cushion for the grains of abrasive. The rubber also acts as a buff to polish out the grain marks saving an extra operation on high finish parts. In the tool room, they are used principally for fluting taps and for wet cutting-off operations. Wheel speeds are over 6,500 sfpm but vary for different operations—wet cutting-off 7,500 to 10,000 sfpm, dry cutting-off 16,000 sfpm, and submerged cutting 5,000 to 6,000 sfpm. Extremely thin wheels can be made in this bond because of their strength and toughness, thereby reducing to a minimum the material lost in making the cut.

Minimum thickness for safe operation at high speeds in cut-off operations

12″	diameter—	$\frac{1}{16}$″	thickness
14″	"	—⅛″	"
16″	"	—⅛″	"
18″	"	—⅛″	"

Grinding wheels bonded with shellac are classed as elastic wheels. These wheels grind with a burnishing or buffing action as a result of the bond softening under the heat of grinding. This action produces a high finish as is

Fig. 2—Resinoid bonded grinding wheels in swing frame grinders are used for snagging heavy castings

required on camshafts and cold mill rolls. In the form of cut-off wheels, the cut can be produced free of discoloration which is important in the preparation of metallographic specimens.

Grain Size (Grit)

The grit or grain of a grinding wheel refers to the size of individual abrasive grains in the wheel. The sizes are indicated by standard numbers corresponding to the meshes per linear inch in the screen employed in sizing the abrasive particles. For example, a grinding wheel of 36 grit contains abrasive grains that will just pass through a screen having 36 openings to the linear inch, but are retained on the next or 46 mesh screen.

Very Coarse	Coarse	Medium	Fine	Very Fine	Extra Fine
6	12	30	70	150	280
8	14	36	80	180	320
10	16	46	90	220	400
	20	50	100	240	500
	24	60	120		600

The factors which effect the selection of grain size depend upon the material to be ground, the amount of stock to be removed and the finish required. The softer and more ductile the material, the coarser the grain size. The larger the amount of stock removal, the coarser the grain size. The better the finish required, the finer the grain size.

Grade (Hardness)

Grade or hardness in a grinding wheel does not apply to the hardness of the abrasive particle but to the grip with which the cutting particles are held in the body of the grinding wheel under grinding pressure. If the bond is strong and capable of retaining the grains against the grinding forces tending to pry them loose, the wheel is said to be a hard grade. If only a small force is needed to release the grains, the wheel is said to be a soft grade.

Figure 6 diagrammatically shows the variance in contact area in cylindrical, surface and internal grinding. The first drawing shows a small contact, necessitating a comparatively hard grade of wheel. Following to the right, the drawings show increased contact area each requiring a softer grade wheel.

Fig. 3—A mirror finish on large steel rolls for rolling of very thin stock. This is a typical "mirror-finish" job using shellac bond wheel.

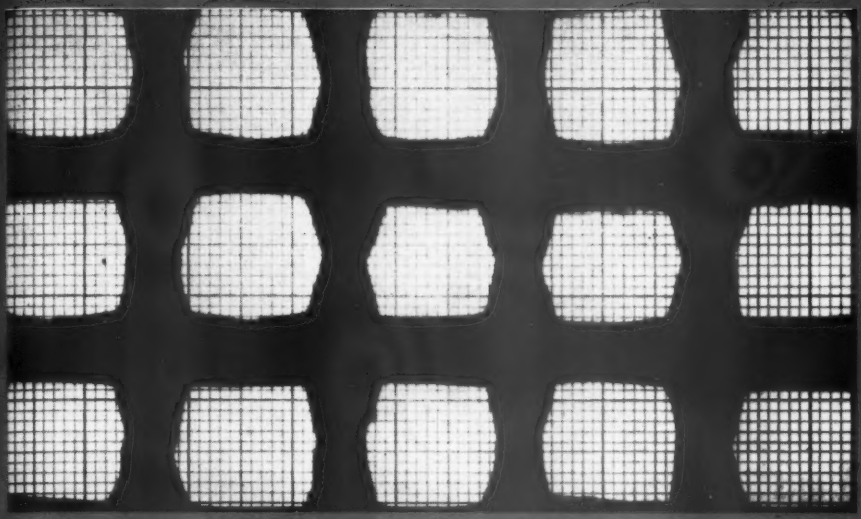


Fig. 4—Magnified section of silk screen used in sizing abrasive grains.

As a guide to correct selection of grade the following factors should be taken into consideration. The harder the material, the softer should be the grade. The smaller the area of contact between the wheel and work, the harder should be the grade. The higher the work speed with relation to wheel speed, the softer the resulting grinding action and harder should be the grade. The presence of vibration in the grinding machine usually calls for a harder grade of wheel than would be required on a machine in good condition. A harder grade of wheel can usually be used if the proper coolant is applied.

Closely related to the wheel grade is the effect of pressure or working stress on the grinding wheel. A grinding wheel which is giving satisfactory grinding action *must* be operated in such a manner that immediately at the grinding face the stresses set up by the wheel rotation and work pressures are close to or at the ultimate impact resistance of the bond and grain structure. A slight increase of pressure or working stress will break grain crystals or dislodge the grains, while a slight decrease in pressure or working stress will permit dulling of crystals and glazing. To sum it up, any reduction in working stresses will cause the wheel to act *harder*. Any increase in the working stresses will cause the wheel to act *softer*.

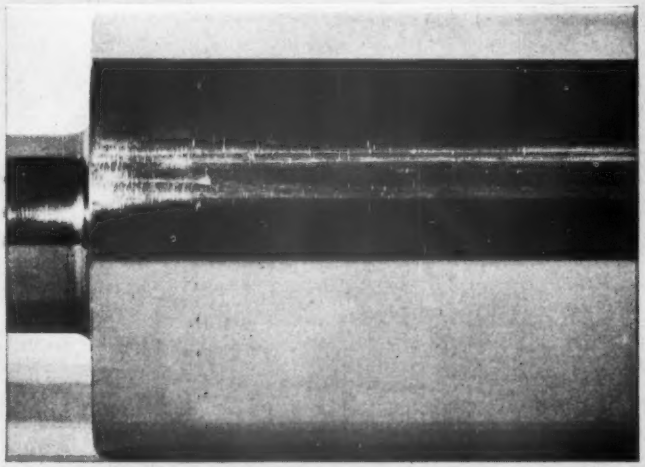


Fig. 5—Scratches on the surface of a roll caused by dirty coolant.

Structure (Grain Spacing)

Two wheels with the same grain and grade, but differing in the quantity or spacing of the abrasive grains will obtain different grinding results. Through a range of grain structures the most effective spacing of the cutting particles for any operation can be obtained.

As a general rule the softer, tougher and more ductile the material to be ground, the more open the structure should be. For fine finish work a wheel with a dense grain structure will give the best results. On surfacing operations a wide or open structure is preferred while cylindrical, centerless and tool and cutter operations are usually best performed with wheels of medium grain spacing.

Truing and Dressing

The true importance of the dressing and truing of a grinding wheel is recognized by the makers of grinding wheels and should be fully understood by the user of such equipment. Every user should realize that proper dressing and truing invariably increases the produc-

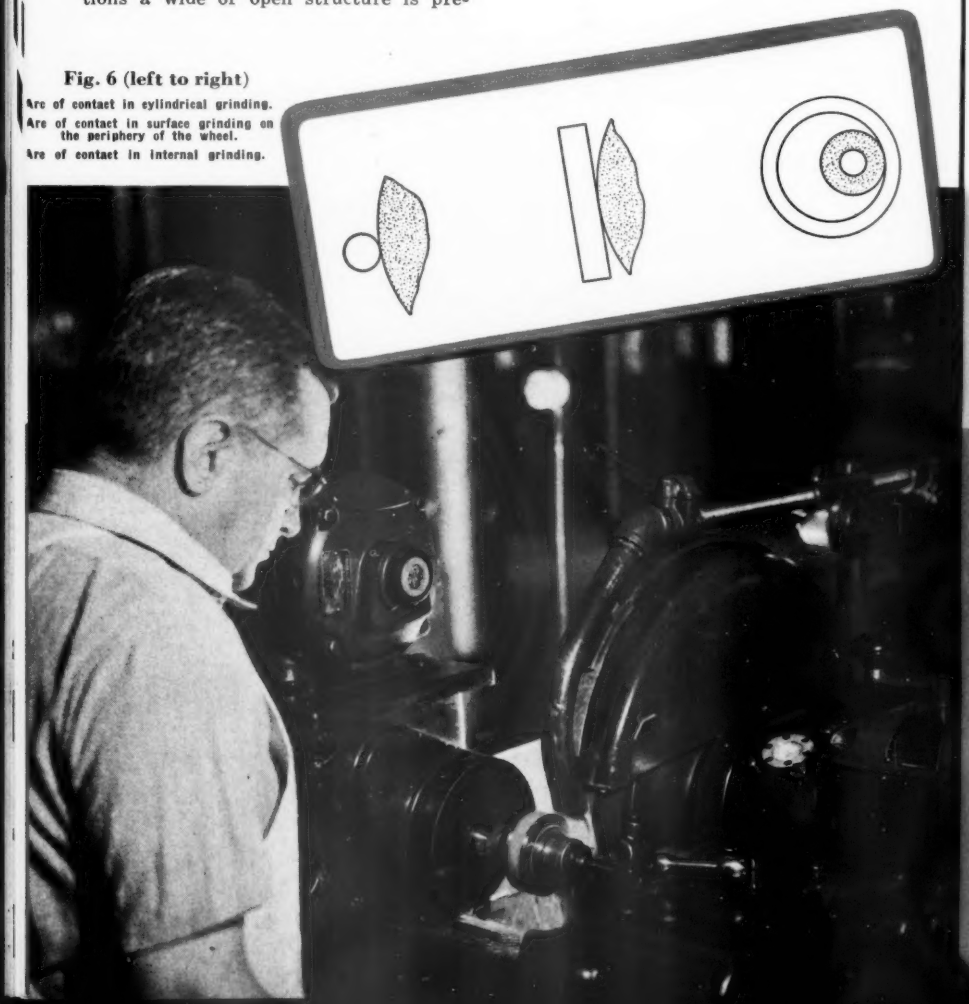


Fig. 6 (left to right)

Arc of contact in cylindrical grinding.

Arc of contact in surface grinding on the periphery of the wheel.

Arc of contact in internal grinding.

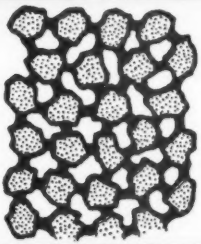
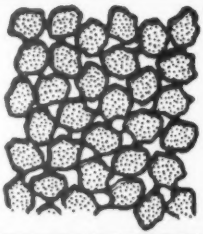


Fig. 7 — A diagrammatic sketch to show how two wheels may be identical in grain size and grade (bond strength) but differ in grain spacing or structure — and thereby differ in grinding action.



Wide abrasive spacing

Close abrasive spacing

tion obtained per wheel, thus reducing the unit grinding cost to the consumer.

The difference in definitions between "dressing" and "truing" is always drawn from a theoretical viewpoint as the two operations are similar and differ principally in the intent or purpose they wish to accomplish.

Truing may be broadly defined as any operation performed on any part of a wheel to create concentricity or parallelism or to alter the wheel shape, either before or after a grinding operation. This may be accomplished with any dressing tool that can be rigidly fixed in relation to the point of contact with the wheel.

Dressing can be defined as any operation performed on a wheel face to change the nature of its cutting action. This is necessary when the individual grain crystals in the wheel face become dulled and the rate of stock removal decreases as the grinding operation is prolonged without dressing. Dressing is also necessary when the abrasive or bond pores become loaded with metal or other materials, since this loading seriously affects the grinding action of the wheel.

All wheels are more or less self sharpening as the dull crystals tend to break away, exposing new sharp points to the work. The dressing tool, however, is designed to assist this sharpening of the wheel face.

For production work, wheels dressed at regular intervals regardless of the apparent need as indicated by the work will pay for themselves in increased work production and longer wheel life.

Wheels for precision grinding, especially for ultra finishes, should be balanced both before and after truing. Wheels when mounted are frequently

out-of-round. If balanced in this condition, the perfect balance is destroyed when the wheel is trued to concentricity, therefore, a rebalancing is required. If the wheel has been trued wet, it should be allowed to dry as the water contained in the wheel pores may cause difficulties in the rebalancing operation. Truing and dressing should be done either at operating wheel speeds or slower—never at higher speeds. Wheels that are in satisfactory balance at operating speeds may be out of balance at higher speeds.

Wheels may be dressed either wet or dry but the operation should always be carried on under the same conditions as when grinding. If a wheel has been used wet while grinding, the pores will retain some of the coolant and cuttings from the dresser tool which adhere to the face and in the wheel pores. On the other hand, a dry grinding wheel will become gummy when grinding, if a coolant has been used during dressing.

The Grinding Machine

The conditioning of the grinding machine plays a large part in selecting the grinding wheel for a particular job. The type of design of the machine is responsible for certain conditions that have to be carefully considered. Heavy, rigidly constructed machines take softer and more open structured wheels than lighter, more flexible types. Some machines set up greater vibration than others, calling for finer, harder and denser structured wheels. Insecure or shaky foundations cause trouble in grinding because hard grades have to be employed to overcome the tendency of the wheel to wear rapidly, with a sacrifice of good grinding quality. The combination of speeds and feeds on some precision machines makes the use of different kinds of wheels necessary. Plane surface grinding machines making use of the rim of a cup or cylinder wheel require much softer wheels having a wider spacing of abrasive grains than do plane surface grinding machines using the periphery of a straight or disc wheel.

Wheel Speed

The speed at which a grinding wheel revolves is important. Too slow a speed means wastage of abrasive without much useful work in return, whereas an excessive speed may result in hard grinding action and may introduce the danger of breakage. It is good practice to operate a grinding wheel as near to the

RECOMMENDED SPEEDS

Type of operation	*Speed in sfpm*
Tool and Cutter grinding	4,500-6,000
Cylindrical grinding	5,500-6,500
Internal grinding	2,000-6,000
Snagging, offhand grinding (Vitrified Wheels)	5,000-6,000
Snagging (Rubber and Resinoid Wheels)	7,000-9,500
Surface grinding	4,000-6,000
Knife grinding	3,500-4,500
Wet Tool grinding	5,000-6,000
Rubber, Shellac and Resinoid cutting-off wheels	9,000-16,000

speed recommended by the maker as possible. The grain, grade and structure recommended for a certain grinding operation is based on the assumption that approximately the recommended speeds will be employed. If this is not possible then the grade at least must be changed to suit the new condition.

Grinding errors like accidents do not merely happen, they have causes.

Work, machine and wheel are the definite, known quantities in the equation. Grinding troubles usually are due, therefore, to the variable unknowns, such as the condition of the grinding machine, skill of the operator in manipulating the wheel, and even to the operator's psychological reaction.

It is the unknown quantities which require expensive time consuming experimentation. Often they are plainly visible to one who knows what to look for. But too often they are ignored and the solution of a grinding problem is sought in a specially made wheel of special characteristics. Such a wheel will often produce a faultless grinding job even under the handicaps loaded upon it, but it seldom will do the job as efficiently as would a standard wheel operated under proper and usually easily attainable conditions. The following tabulations of grinding faults will serve to show how many a grinding problem can be solved without recourse to specially made wheels.

Cylindrical Grinding
Chatter

Effect: Chatter marks—short, close and evenly spaced.
Cause: Loose wheel spindle bearings.
Correction: Reduce speed; tighten or refit bearings; lap bearings to spindle; increase quantity or improve quality of oil; allow sufficient preliminary heating; take up thrust bearings.

Effect: Chatter marks—slightly longer and more widely spaced.
Cause: Wheel spindle sprung or out of round.
Correction: If warped, replace; if out of round, regrind and lap to new bushings.

Effect: Regularly spaced chatter marks.
Cause: General vibration.
Correction: Check alignment and couplings; be sure motor and spindle are in balance.
Cause: Wrong work speed.
Correction: Determine, by experiment, speed where vibration is at a minimum.

Effect: Regularly but widely spaced marks.
Cause: Uneven belt.
Correction: Plane belt to uniform thickness and width; have all sections of uniform pliability.
Cause: Idlers loose or out of balance.
Correction: Rebush and lap to shaft; balance carefully.

Effect: Long, regularly spaced chatter marks forming checkerboard pattern.
Cause: Wheel out of balance.
Correction: Rebalance carefully on own mounting; repeat after truing operation. If trouble persists, run wheel without coolant to throw off excess water; store on side to prevent water from settling at lower edge of wheel.
Cause: Wheel out of round.
Correction: True before and after balancing; true sides to face.

Effect: Chatter marks, long and widely spaced; regular in pattern, but may vary around body of work.
Cause: Backlash in drive gears.
Correction: Replace old gears or use belt drive; check lubricant.

Effect: Regular or irregular chatter marks.
Cause: Faulty thrust bearings.
Correction: Replace thrust bearings.

Effect: Regularly or irregularly spaced chatter marks of any width, but following one pattern.
Cause: Metal belt lacing on spindle drive.
Correction: Use endless belt.

Effect: Regularly spaced marks occurring more frequently than when caused by belt lacing.
Cause: Loose pulley on spindle.
Correction: Tighten pulley on spindle.

Effect: Chatter marks spaced synchronously with building vibration.
Cause: Building vibration.
Correction: If a heavy grinder—provide a separate foundation independent

of the surrounding floor. If a light grinder—tighten or loosen anchor bolts. Vibration dampers often will help. Moving the machine to a better location is sometimes the best solution.

Effect: Chatter marks fairly long, wide and evenly spaced at wide intervals and generally discolored; wheel glazed or loaded.

Cause: Wheel grading too hard.

Correction: Select softer grade, more open bond, or coarser grit. See "Wheel Glazing."

Effect: Irregular chatter marks.

Cause: Work centers or work rests not true, or improperly lubricated.

Correction: Check fit of centers and rests; provide constant and even lubrication; on large jobs, such as in roll grinding, provide hold-down clamps on necks and arrange for adequate lubrication.

Effect: General.

Cause: Dressing.

Correction: Use sharp diamond—rigidly held close to wheel.

Scratching of Work

Effect: Narrow and deep regular marks.

Cause: Wheel too coarse.

Correction: Use finer grit.

Effect: Wide irregular marks of varying depth.

Cause: Wheel too soft.

Correction: Use harder grading. See "Wheel Grading."

Effect: Widely spaced spots on work.

Cause: Hard spots or glazed areas on wheel face.

Correction: Balance and true wheel; avoid getting oil on wheel face.

Effect: Uneven marks on work.

Cause: Whipping belt.

Correction: Take up belt.

Effect: Fine spiral or thread on work.

Cause: Faulty wheel dresser.

Correction: Replace cracked or broken diamonds; use slower dressing traverse; set tools at angles of 5 deg. down and 30 deg. side; turn diamond every third dressing; tighten holder or diamond; dress with less penetration; do not allow tool to dwell in contact with wheel; do not start dressing cuts on face—locate tool on face, but start cuts from edge; make final pass in dressing in opposite direction to grinding traverse; traverse diamond across face of wheel evenly; round off wheel edges—chamfering or dressing back is not sufficient.

Cause: Faulty operation.

Correction: Prevent penetration of advancing or following edge of wheel by being careful to dress wheel face parallel to work; reduce wheel pressure; replace worn parts which permit swiveling of wheel head; provide additional steady-rests; reduce traverse in relation to work rotation; when making numerous passes, make slight change in traverse rate at each pass to break up pattern.

Effect: Wavy traverse lines.

Cause: Ragged wheel edges.

Correction: Round off wheel edges.

Effect: Uneven traverse lines.

Cause: Worn traverse drive parts.

Correction: Eliminate play; replace worn parts.

Effect: Isolated deep marks.

Cause: Improper wheel dressing.

Correction: Use sharper dressing tools; brush wheel after dressing, preferably with a stiff bristle brush.

Cause: Chatter or hammering.

Correction: Remove cause. See "Chatter."

Cause: Coarse grits or foreign matter in wheel face.

Correction: Dress out.

Cause: Bond disintegrates; grit pulls out.

Correction: Coolant too strong for some organic bonds; decrease soda content.

Effect: Irregular marks.

Cause: Loose dirt.

Correction: Keep air and shop clean; install dust collectors.

Effect: Irregular marks of various lengths and widths; scratches usually "fish-tail."

Cause: Dirty coolant.

Correction: Provide efficient filter; clean tank frequently; flush guards, etc., after dressing and when changing to finer wheels.

Effect: Deep, irregular marks.

Cause: Loose wheel flanges.
Correction: Tighten flanges, using blotters or lead washers.

Spirals on Work

Effect: Spirals (traverse lines) same lead on work as rate of traverse.
Cause: Misalignment.
Correction: Check alignment of head and tail stocks, also wheel head to work.
Cause: Truing.
Correction: Have truing tool set exactly on work—wheel contact line, but pointed down 3 deg. Round off edges of wheel face.

Wheel Grading Effect

Effect: Lack of cut; glazing; some loading; burning of work; chatter.
Cause: Wheel too hard in effect.
Correction: Increase work and traverse speeds; decrease spindle speed, wheel diameter and width of wheel face; open up wheel by sharper dressing; increase wheel pressure (in-feed); use thinner coolant, avoid dwelling at end of traverse; avoid gummy coolants; use coarser grit and softer bond.
Effect: Wheel marks; short wheel life; not holding cut; tapered work.
Cause: Wheel too soft in effect.
Correction: Decrease work and traverse speeds and wheel pressure (in-feed); increase spindle speed, wheel diameter and width of wheel face; dress with slow traverse and slight penetration; use heavier coolants; filter coolants; do not pass off work at end of traverse.

Wheel Loading

Effect: Metal lodged on grains or in wheel pores.
Cause: Incorrect wheel.
Correction: Use coarser grit, or more open bond, to provide chip clearance; use abrasive that fractures more easily; use more coolant.
Cause: Faulty dressing.
Correction: Use sharper dresser; dress faster; clean wheel after dressing.
Cause: Faulty coolant.
Correction: Use more, cleaner or thinner coolant.
Cause: Faulty operation.
Correction: Manipulate to soften effect of wheel (see "Wheel Grading Effect"); use less in-feed.

Wheel Glazing

Effect: Shiny appearance; slick feel.
Cause: Improper wheel.
Correction: Use coarser grit, softer bond; manipulate wheel to soften effect. (See "Wheel Grading Effect.")
Cause: Improper dressing.
Correction: Keep wheel sharp with sharp dresser; faster traverse; more tool penetration.
Cause: Faulty coolant.
Correction: Use less oily coolant; use more coolant.
Cause: Faulty operation.
Correction: Use greater in-feed. See "Wheel Grading Effect."
Cause: Gummy coolant.
Correction: Increase soda content if water is hard; do not use soluble oils in hard water.

Inaccuracies in Work

Effect: Work out of round.
Cause: Uneven pressure of driving points.
Correction: Provide cushion between points and work; place points equidistant from work axis.
Cause: Driving points not parallel with axis.
Correction: True faceplate and pins.
Effect: Work out of parallel or tapered.
Cause: Faulty grinding machine.
Correction: Correct worn ways and setting of tail or head stocks; tighten spindle bearings.
Cause: Improper dressing.
Correction: Make sure machine conditions are same at point of dressing as at point of grinding.
Cause: Improper operation.
Correction: Do not permit wheel to pass off work at end of traverse, which causes taper at work ends; decrease pressure, which springs work; use harder wheel.

Fig. 10—A typical through-feed centerless grinding job.

Fig. 11—A plunge cut operation on a valve stem.

Cause: Expansion of work.
Correction: Reduce temperature of work by using more coolant and lighter cuts; keep work out of drafts.

Checking of Work

Effect: Work shows check marks.
Cause: Improper wheel manipulation.
Correction: Prevent wheel from acting too hard (see "Wheel Grading Effect"); do not force wheel into work; use larger and more even flow of coolant; prevent belt slippage.

Burning of Work

Effect: Work shows discoloration.
Cause: Improper wheel.
Correction: Use softer wheel or manipulate to get softer effect (see "Wheel Grading Effect"); prevent glazing and loading; use more coolant; prevent chatter.
Cause: Faulty operation.
Correction: Bring wheel to work more gradually, use less in-feed; eliminate belt or wheel slippage; prevent possible stoppage of work.

Centerless

Effect: Irregular light and dark spirals.
Cause: Stock.
Correction: Remove all oil from stock straightener, use detergent coolant.
Cause: Dressing.
Correction: Dress regulating wheel at same angle as wheel setting, otherwise small diameter work may be bent while traversing due to uneven pressure. If clearance angle is wanted—apply to grinding wheel.
Effect: Scratching (Fine Wheel).
Cause: Work Support Blade.
Correction: For ultra-finish grinding, Bakelite work support blades are best.
Effect: Scratching (General).
Cause: Work Support Blade.
Correction: For soft steel use cast iron work support blades.
Effect: Periodic deflections of work.
Cause: Work Support Blade.
Correction: Reduce top angle. For large diameter work the blade angle should be less than when using the same length of blade for smaller diameter work.

Effect: Chatter.
Cause: Wheel.
Correction: Too hard or too fine; loose on mount.
Effect: Chatter.
Cause: Work Support Blade.
Correction: Too sharp an angle or not properly clamped.
Effect: Scoring.
Cause: Coolant.
Correction: Requires more lubricating qualities.
Effect: Spirals on work.
Cause: Wheel cutting too heavily on front or back or cutting both front and back and not in center of wheel.
Correction: Dress grinding wheel so that it cuts from front to within ½" to 1" back of edge.
Cause: Work support plates not parallel with work contact line on regulating wheel.
Correction: Line up guide plates with lining bar approximately same diameter as work being ground.
Correction: If guides are parallel and wheel dressed correctly, increase regulating wheel housing angle ½ deg. more than regulating wheel truing device angle.
Effect: High centers, low ends on work.
Cause: Improper alignment of guides or regulating wheel angles.
Correction: Align guides and if still at fault decrease regulating wheel angle by ¼ deg. steps until corrected.
Effect: Low centers on work, high ends.
Cause: Improper alignment of guides or regulating wheel angles.
Correction: Align guides and if still at fault increase regulating wheel angle by ¼ deg. steps until corrected.
Effect: Work out of round.
Cause: Too heavy stock removal on roughing cuts.
Correction: First cut light, to round up work, then use heavier cuts.
Cause: Too few passes on hardened work.
Correction: Increase number of passes if necessary.
Cause: Too near center line of wheels.
Correction: Raise center height of work to one-half diameter of work above center line of wheels.
Cause: Wheel grade too hard.
Correction: See that copious supply of clean coolant is available at point of contact.
Cause: Not enough coolant at point of contact.
Correction: As last resort use softer wheel grade.
Effect: Chatter.
Cause: Loose spindle bearings or other loose drive parts.
Correction: Lap spindle bearings.
Cause: Too high above center.
Correction: Decrease center height.
Cause: Too great angle on work rest.

Fig. 12—"Chatter" Marks caused by glazed or loaded wheel.

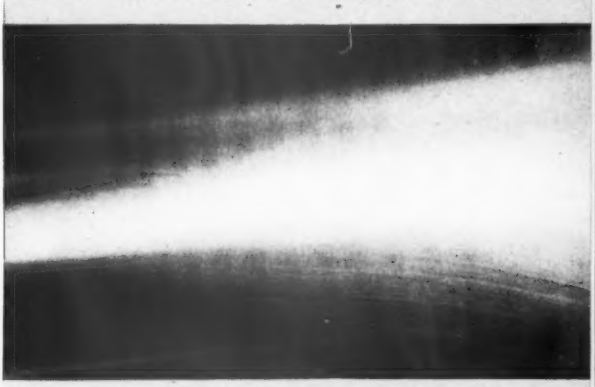


Fig. 13—Traverse lines caused by wheel dressed on a taper.

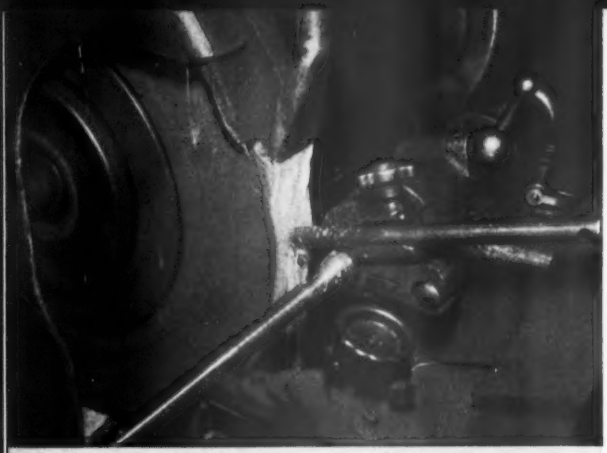


Fig. 14—Use a generous flow of coolant if possible when truing with a diamond.

Correction: Use 30 deg. blade angle which is sufficient in 90% of cases.

Effect: Unable to straighten kinks out of shaftings.

Cause: Shafting not straightened in punch presses or other devices.

Correction: Straighten as close as possible: a centerless grinder is not a straightening machine.

Cause: Failure to allow enough stock on work for grinding.

Correction: Allow grinding stock to equal from 2½ to 3 times the amount of run out.

Cause: Too great grinding pressures.

Correction: On first pass through grinder, take light cut at low wheel speed and high traverse rates.

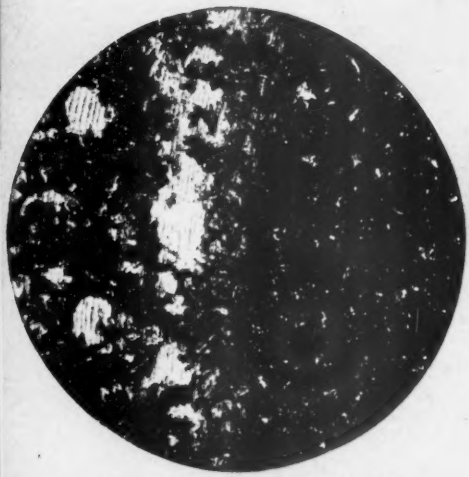
Internal Grinding

Source of Fault: Spindles.

Correction: High speed internal grinder spindles of the ball-bearing type are very sensitive to slight irregularities. Because of their special construction and special races and balls, it is best that repairs be made only by the spindle manufacturer. Lubrication of spindles is of great importance. Use only the lubricants recommended by the spindle manufacturer.

Source of Fault: Machine Play.

Correction: Since both wheel and work heads may be of the swiveling type, they



Photomicrograph showing the face of grinding wheel. The left half clearly shows the wheel face heavily loaded with metal. The right half of the illustration shows wheel face after redressing.

Photomicrograph of wheel face showing left half dressed with a dull diamond, the right half after being dressed with a sharp diamond.

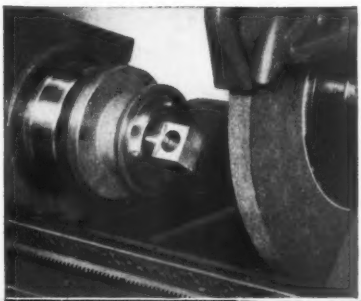
Fig. 15

Fig. 16—Effect of out-of-round and out-of-balance in wheel.

must be checked for play and anchorage.

Source of Fault: Belts.

Correction: Internal grinder belts, with their high speed, short centers and small diameter pulleys, must be frequently checked for oiliness, wear and tightness, as slippage is an especially serious fault.



Source of Fault: Dressing.

Correction: Faulty dressing is one of the most frequent causes of faulty grinding, short wheel life and poor finishes. Keep careful watch to prevent wear in the diamond holder bearings. Because of the small size of the wheels used in internal grinding, it is essential that the diamond be of proper size and maintained with a sharp point.

Source of Fault: Wheel Characteristics.

Correction: Most internal wheels are less efficient than other wheels because of the extreme change in wheel diameter with no corresponding change in spindle speed. Often it is possible to increase wheel life by using a wheel of greater width. Due to the limitations of chip clearance in internal grinding, it is necessary to use coarse, open wheels.

Source of Fault: Unwanted Tapers in Straight Holes.

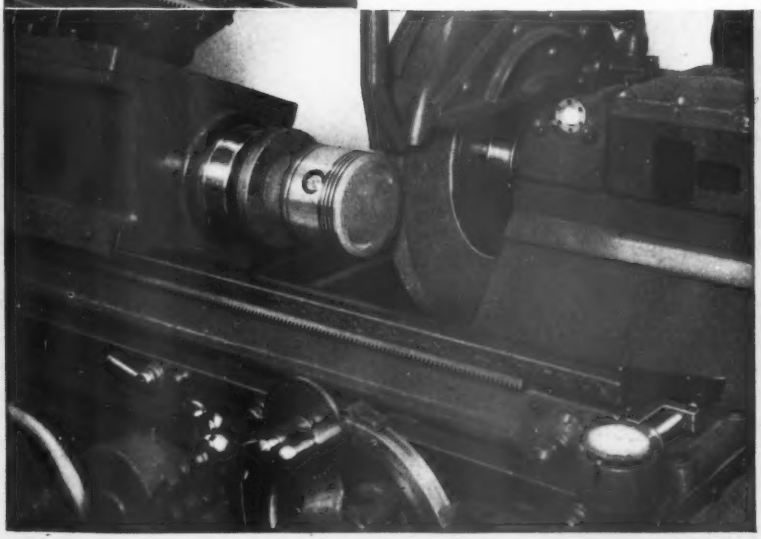


Fig. 17—A typical application of cylindrical grinding.

Correction: Be sure wheel head is parallel with table travel; use softer wheel or increase work speed for softer effect; correct work or wheel head angling; prevent gumminess of coolant; use lighter in-feed; be sure wheel is dressed parallel to table travel; use harder wheel.

Source of Fault: Bell-Mouthing.

Correction: Reduce over-travel of wheel from hole.

Source of Fault: Faulty Taper.

Correction: Be sure wheel is parallel to desired taper; eliminate backlash in headstock; harden or soften wheel effect as required (see "Wheel Grading Effect").

Wheel Breakage

Source of Fault: Radial Break, three or more pieces.

Correction: Reduce wheel speed to rated speed. Correct improper mounting such as: lack of blotters or pads, tight arbors, uneven flange pressure, dirt between flanges and wheel. Prevent overheating due to lack of coolant, or excessive wheel pressure on work. Do not allow wheel to become jammed on work.

Source of Fault: Radial Break, two pieces.

Correction: Prevent excessive side strain.

Source of Fault: Irregular break.

Correction: Do not allow wheel to become jammed on work; prevent blows on wheel; don't use wheels that have been damaged in handling; examine wheel before using. Sound wheel by tapping.

Source of Fault: General.

Correction: Do not use a wheel that is too tight on the arbor as wheel will break when started. Prevent excessive hammering action of wheel. Familiarize yourself with the provisions of the safety code governing use of grinding wheels—and observe the rules.

We are indebted to the Carborundum Company and Norton Company for illustrations and much of the textual data used in this section.

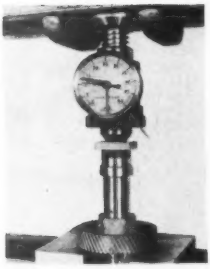
REPRINTS AVAILABLE

This special section is available in reprint form to individuals and department heads responsible for grinding operations. Requests for additional copies should be addressed to:

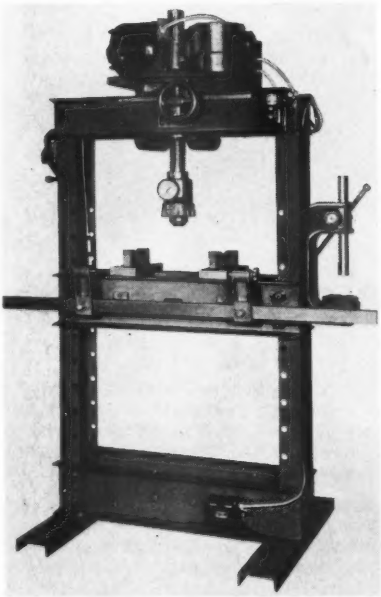
TOOL & DIE JOURNAL

2460 Fairmount Blvd.
Cleveland, Ohio

PRESSUREMATIC



AUTOMATIC PRESSURE CONTROL IS IDEAL FOR TRY-OUTS AND ASSEMBLING DIES



By setting the control gauge on the Lempco Electric Arbor Press, you can duplicate exact working pressures on your try-outs. For making samples, assembling dies, press fitting guide pins, and mating the punch and die, the Lempco Pressurematic is just what contract and captive die shops need. Exerts the steady, continuous flow of pressure required for accurate trial-and-error checks. Pressurematics are made in both Electric and Hydraulic models.

MAJOR SPECIFICATIONS—SERIES 300

Width between Columns . . . . 36¾"
Ram Travel (Standard) . . . . . 9¼"
(Larger ram travel available)
Maximum Bolster Travel . . . . . 36"
Ram Speed (Inches Per Min.) 3 or 7
(Other Speeds Available)
Pressure (Tons) . . . . . Up to 60

FOR COMPLETE SPECIFICATIONS WRITE

Prompt Delivery! Priorities Can Be Had — Write Us.

SEE ONE WORK — MAIL THIS COUPON

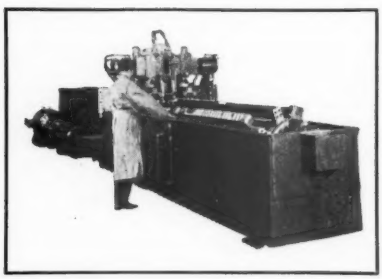
LEMPCO
PRODUCTS · INC.
BEDFORD · OHIO · U·S·A
ESTABLISHED 1919

Lempco, Dept. TD, Bedford, Ohio
GENTLEMEN: Tell me plant nearest me where I may see a LEMPCO Press in operation.

NAME .....
ADDRESS .....
CITY.....STATE.....

6 BROACHING OPERATIONS *with* 1 MACHINE SET-UP...

...ON 75 MM CANNON BREECH BLOCK



. . . "Somewhere in the Middle West", a mammoth gun plant is producing breech blocks for 75 MM Cannon with the aid of the special AMERICAN broaching machine shown to the left.

The revolving broach handling cradle can be seen to the front of the machine. This machine facilitates broaching one of the large breech blocks while another is being loaded on the opposite side of the special fixture. Compared to machining these blocks by conventional methods, production obtained is very high.

AMERICAN BROACH & MACHINE COMPANY
ANN ARBOR, MICHIGAN, U. S. A.
BROACHING MACHINES, PRESSES, BROACHING TOOLS, SPECIAL MACHINERY

Division of SUNDSTRAND MACHINE TOOL CO.

Tool Salvage By Low Temperature Welding

Welding is playing an important part in conserving critical tool steels. This article gives in detail some low temperature welding suggestions for salvaging broken and worn out tools.

THE increasing critical shortage of cutting tools and tool steel caused by expanding war production was anticipated by a number of large tool users. Several methods were developed for salvaging and maintaining tools. This article presents a practical procedure, tested under actual working conditions, for repairing broken tools.

Eutectic joining is a low temperature welding process for repairing broken tools with special brazing alloys of high tensile strength. Three new alloys used with an ordinary oxy-acetylene torch were developed for solidly joining together broken tool parts with a minimum of temperature and distortion.

The first of these alloys is non-ferrous and gives joints with a tensile strength as high as the parent metal. Results up to 117,000 psi can be obtained on these joints. This alloy is used the same as silver solder. No chamfer is required. A flux is used which will protect and clean the metal and assist the flow of the joining alloy into tight fitting assemblies with a press fit of only .001". An advantage is that a chamfer can be used to control the flow and still the tool will be sufficiently strong. The cutting edge is not chamfered—thus preserving the heat treatment. If a part is missing, the alloy will fill without difficulty. Excellent bonding is due to the composition of the alloy and to the strong action of the flux.

An engine manufacturer, cutting fins in aircraft engines, used worn cutting tools as short as one inch, by welding two pieces on a shaft made from high carbon or mild steel. Within a few months this manufacturer has saved thousands of dollars worth of tools.

There may be a question as to whether a temperature of 1300° or 1400° F will affect the steel. If the joint is made on heat treated steel, it undoubtedly will have an influence. Therefore, this type of alloy can be used wherever a slight variation of the hardness will not be of great importance. When the joint is directly on a cutting edge where hardness should be maintained, a second joining alloy is recommended. This alloy requires only 940° to 1020° F, although it melts at 1120° F. Experience has

By R. D. Wasserman
Welding Engineer
Eutectic Welding Alloys, Inc.

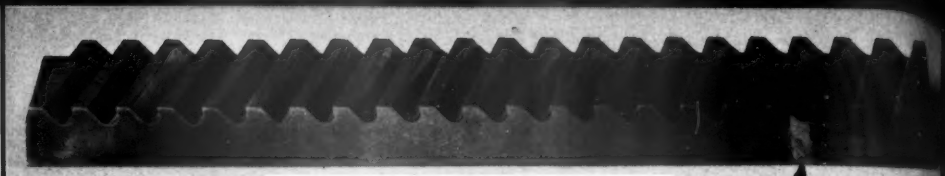


Fig. 1—Flat broach welded.

shown that at this temperature most tools can be joined without drawing the hardness. Its tensile strength is much lower—53,000 psi. However, it has been found that when used on close-fitting joints its strength is increased as high as 143,000 psi. Because of the lower temperature involved additional preparation is necessary.

A third alloy is applicable when a part is missing and has to be filled. This alloy is not free flowing and is applied at a temperature between 1000° and 1200° F. It will fill the missing part without drawing the temper of the steel. A hardness of approximately 235 Brinell is obtained by fast cooling.

Another alloy, melting at 354° F, has been developed for attaching high speed steel tips and small drills to shanks. The low temperature makes it handy to use without scaling or over-heating and permits easy removal or replacement.

Procedures for applying these alloys are not complicated but require a certain amount of care and precaution which are outlined as follows:

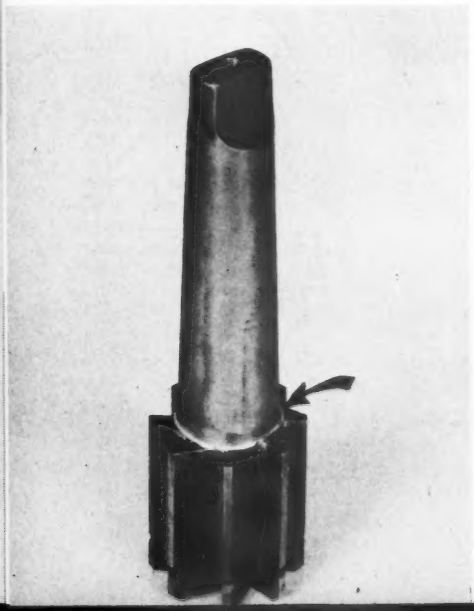


Fig. 2—Special drill welded to alloy steel shank.

SALVAGING BROKEN BROACHES

High tensile alloy to be used with corresponding flux.

A. Do not chamfer; butt joint as broken (except at cutting edge in order to avoid spoiling the heat treatment). Clean joints thoroughly with carbon tetrachloride, using a soft bristle brush.

B. Prepare joint-ends by coating with flux and a thin skim of high tensile alloy which is applied by preheating ends with soft torch having a large acetylent excess. Allow the alloy to flow thinly.

C. Clamp all pieces in alignment fixture. If fixture is particularly heavy preheat carefully to approximately 1400° F so that the fixture will not chill the part which is to be welded.

D. Butt braze. Reheat joint until the alloy remelts and then press together tightly — additional alloy may be added to fill any crevices. A two-flame torch is recommended to heat joint uniformly.

E. Remove flash by filing or grinding.

F. Sharpen if necessary.

MAKING MILLING CUTTERS FROM SCRAP MATERIALS

High tensile alloy to be used with corresponding flux.

A. Select suitable mild steel blank (at least $\frac{3}{16}$" thick) to be used for hub blank, and worn-out milling cutter blades, to be used for teeth.

B. Machine hub blank to correct proportions.

C. Cut slots on index milling machine to suit.

Fig. 3—Flat broach rebuilt.

D. Chamfer outside edges of slots in blank.
E. Clean blades and blank thoroughly with carbon tetrachloride, using a soft bristle brush.
F. Press blades in blank slots.
G. Coat joints of teeth in slots with flux. Now heat with large torch, medium pressure and large acetylene excess. As soon as the flux melts completely and beginning of cherry red is reached, start to add the high tensile alloy into the slots.
H. Grind entire cutter.

SALVAGING MILLING CUTTERS AND SLITTING SAWS

High tensile alloy to be used with corresponding flux.
A. Grind V-slot on hand grinder along fractures. (Do not chamfer cutting edges.)
B. Clean joints thoroughly with carbon tetrachloride using a soft bristle brush.
C. Prepare joints by coating with flux. Make base plate to clamp parts in perfect alignment.
D. Preheat base plate to 1400°-1600° F.
E. Clamp cutter flat on plate.
F. Fill in V-slot. Use a mild flame with acetylene excess. Weld V-slot from inside toward outside using ⅛" rod.
G. Grind both sides completely.

Attention: This procedure is successful with tools of at least $\frac{3}{16}$" thickness or more. Thinner tools are more difficult to reclaim because of the distortion which may occur.

SALVAGING MILLING CUTTERS

High tensile alloy to be used with corresponding flux.
A. Chamfer edges of fracture in open "V" except near cutting edge.
B. Clean joints thoroughly with carbon tetrachloride, using a soft bristle brush.
C. Prepare joints by coating with flux.
D. Prepare a special plate—clamp the tool on to secure perfect alignment. Preheat this plate to 1400°-1600° F.
E. Clamp broken piece in cutter.
F. Fill in V-slot with high tensile alloy by using a soft torch with acetylene excess. Weld from inside and toward outside.
G. Remove excessive flash and resharpen.

RE-USING WORN OUT FORM TOOLS

Very low temperature welding alloy to be used with corresponding flux.
A. Grind joint-end of tool and shank and square for welding.
B. Clean joints thoroughly with carbon tetrachloride, using a soft bristle brush.

Fig. 4—Milling Cutter.

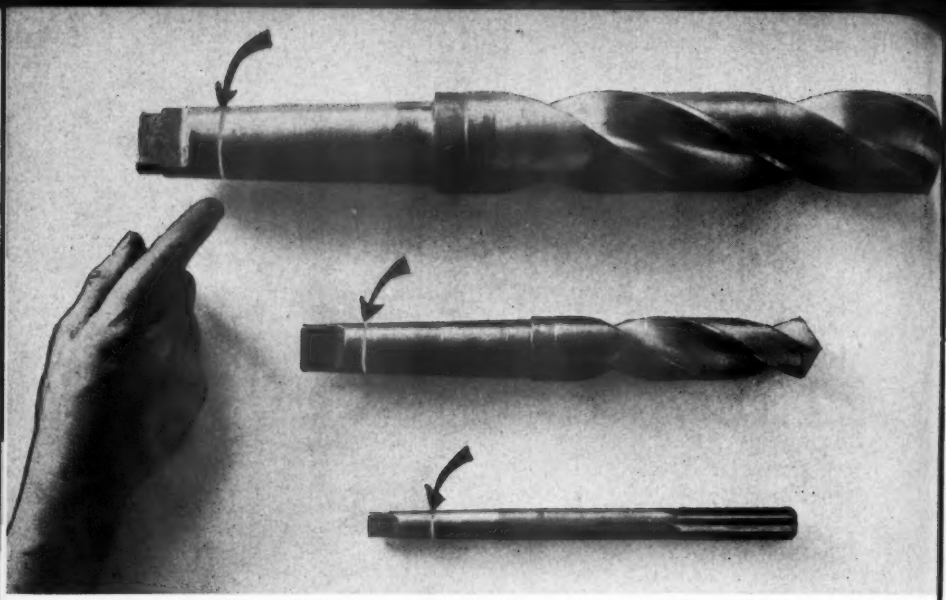


Fig. 5—Eutectic joining used to salvage drills.

C. Prepare joint-ends by coating heavily with flux. Heat to beginning of dull red with a soft flame with large acetylene excess. Have a thin skim of low temperature welding alloy flow on both ends separately.

D. Clamp both parts in alignment fixture.

E. Reheat joint-ends with low temperature welding alloy with soft torch with large acetylene excess until the alloy remelts—then press together. A two-flame torch will heat uniformly.

F. Remove flash by filing or grinding.

G. Resharpen.

Note: If mild steel shank is used the high tensile alloy is recommended. Concentrate heat almost entirely on mild steel shank.

WELDING EXTENSION REAMERS FROM STANDARD REAMERS

Very low temperature welding alloy to be used with corresponding flux.

A. Select two scrap standard reamers of proper size.

B. Cut off desired piece of one reamer.

C. Grind joint-ends square and smooth.

D. Clean joints thoroughly with carbon tetrachloride, using a soft bristle brush.

E. Prepare joint-ends by coating with flux. Heat both ends separately and precoat the surface of *one* of the two ends to be welded with a thin skim of low temperature welding alloy. Add again a small amount of flux.

F. Clamp in alignment fixture.

G. Heat joint-ends with soft torch with large acetylene excess until the alloy remelts—then press together.

H. Remove flash by filing or grinding.

I. Grind OD to proper size.

J. Back off.

K. Sharpen.

SALVAGING UNDER-SIZE FLAT BROACHES BY BUILDING UP TO ORIGINAL SIZE

High tensile alloy to be used with corresponding flux.

A. Select suitable mild steel filler block and machine to proper height.

B. Chamfer edges of filler block and also the under size of broach.

C. Clean joints thoroughly with carbon tetrachloride, using a soft bristle brush.

D. Prepare joints by coating with flux.

E. Clamp both pieces together.
F. Spot weld at intervals along chamfered edges. (A continuous weld would create too much heat and would cause annealing). Use torch horizontally with high tensile alloy.
G. Drill mounting holes in proper place.
H. Regrind broach.

HOW TO RE-USE WORN OUT HIGH SPEED TOOL BITS

Low temperature welding alloy to be used with corresponding flux, except where high tensile strength is required. In these cases use the high tensile alloy.
A. Select used tool bit and mild steel shank.
B. Grind joint-ends square and smooth for brazing.
C. Clean joints thoroughly with carbon tetrachloride, using a soft bristle brush.
D. Prepare joint-ends by coating with flux and then heat both ends separately. Coat the surface of one of the two ends to be joined with a thin skim of the low temperature alloy—use a mild flame with a large amount of acetylene excess—then add a small amount of flux.
E. Clamp on alignment fixture.
F. Reheat joint until the alloy remelts, then press together.

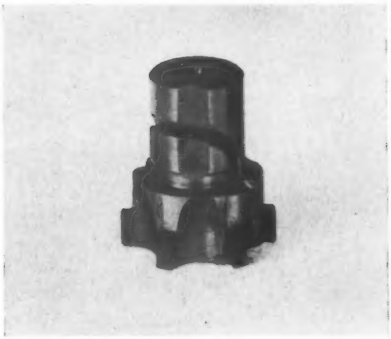


Fig. 6—Dovetail tool rebuilt.

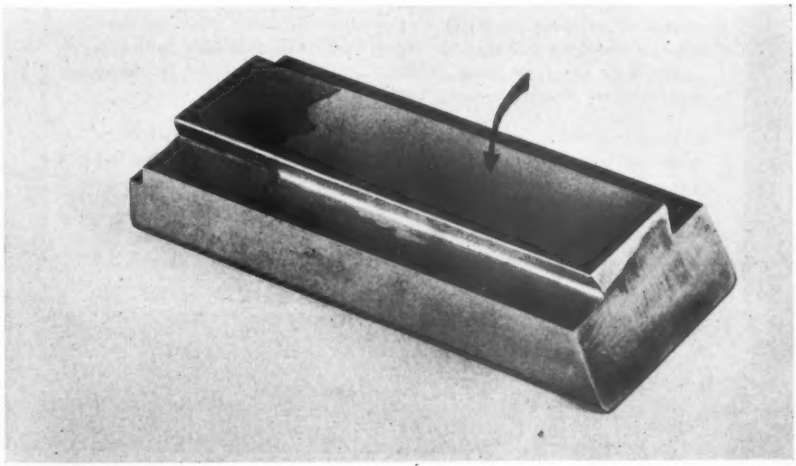
G. Remove flash by filing or grinding.
H. Regrind.

SALVAGING DRILLS BROKEN INTO FLUTES OR CUTTING END

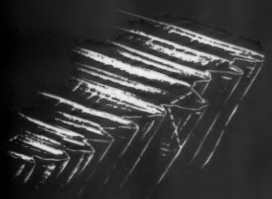
Very low temperature welding alloy to be used and corresponding flux.
A. Square broken ends by grinding.
B. Grind a straight V-slot across end of one piece.
C. Taper end of other piece to fit the above V-slot.
D. Clean joints thoroughly with carbon tetrachloride, using a soft bristle brush.

(Continued on Page 124)

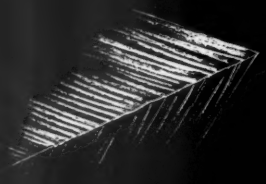
Fig. 7—Thread cutting tool ready for welding.



INCREASE TOOL LIFE
Many Times
by refined surface finishing



This cutting edge will dull quickly



This cutting edge will have long life

UNDER high magnification a cutting edge as ordinarily ground would show "hills" and "valleys" like the left-hand illustration. You can easily see that when the tool is put in use the unsupported peaks are unequal to the load imposed upon them and quickly break off leaving flat spots that rub instead of cut. This places a greater load on the remaining edge which in turn fails quicker than it would if the edge were straight and the load equally distributed.

Norton engineers, working with prominent tool engineers, developed a method of producing the straight, even edge that means equalized loading and thus long tool life. For cutters and other multiblade tools it is a fine grain Crystolon wheel (37320-J8L or 37320-H8T-4) and for single point tools an Alundum wheel (38220-L9BE).

In many tool rooms these wheels are now producing a refined surface finish that is multiplying tool life many times—a tremendously important point today when tool steels are so scarce. A booklet "How to Increase Tool Life" gives you the complete story. Just ask for Form 986-TD.

NORTON COMPANY, WORCESTER, MASS.

W-895

NORTON ABRASIVES

WHY TRUFORM IS IMPORTANT *today*

Truform Non-Shrinkable Die Steel, for use in applications where extreme accuracy is essential, has the ability to retain its shape, which eliminates expensive replacement of dies and tools ruined by distortion during heat treatment. It can be used to advantage by both inexperienced men as well as by veterans of the industry.

TRUFORM has 4 outstanding characteristics:

1. Non-shrinkable
2. Greater Hardness
3. Exceptional Toughness
4. Machinability

Write for a copy of our new booklet listing applications and working data. Use of Truform results in longer die life and minimum press shut-down time; both factors being essential to production speed-up and war-time conservation of steel and machines and man hours.

JESSOP

JESSOP STEEL COMPANY
WASHINGTON, PENNA., U. S. A.

JESSOP STEEL CO. FINE JESSOP STEELS WASHINGTON, PA.

JESSOP STEELS FOR AMERICA AND HER ALLIES

CARBON · HIGH SPEED · SPECIAL ALLOY · STAINLESS · COMPOSITE STEELS

THE IMPROVED LINLEY

HIGH-SPEED VERTICAL MILLING MACHINE AND JIG BORER

A COST-CUTTER ON SMALL PRECISION WORK
LARGER TABLE AND MORE CLEARANCE

This new machine pays for itself on die, jig and fixture work as well as molds for plastics, metal pattern work, laying out, drilling, milling and boring operations.

Fast and simple with correct speeds to insure safety to tools. Ball bearing equipped; micrometer screw feed head.

Use the LINLEY and release your large machines for heavy work. Write for Descriptive Bulletin and detailed specifications.

LINLEY BROTHERS CO.
662 STATE ST. EXT.
BRIDGEPORT CONN. U.S.A.

How you can save on Diamond Wheels!

TYPICAL COMPARATIVE DIAMOND WHEEL COSTS

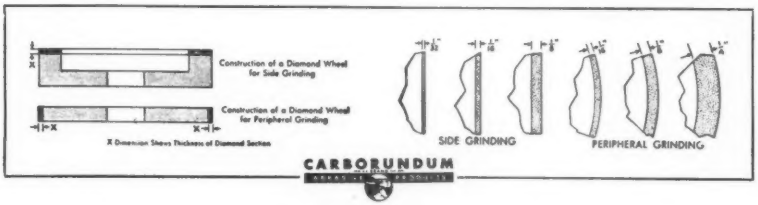
	Depth Diamond Section	Cost per Wheel	Number Wheels Required for Equal Service	Total Cost for Same Amount of Grinding Service	Saving Resulting from Using Thicker Section
TYPE D6W CUP WHEEL					
Diamond in Rim 6" x ¾"—¾" Rim 100 Concentration	1/32"	$63.55	4	$254.20	$69.55
	1/8"	184.65	1	184.65	
Same Wheel 50 Concentration	1/16"	63.55	2	127.10	23.20
	1/8"	103.90	1	103.90	
TYPE D1T STRAIGHT WHEEL					
Diamond in Periphery 6" x 1/8" 100 Concentration	1/16"	30.05	4	120.20	46 40
	1/4"	73.80	1	73.80	

● The thickness of the diamond, or grinding, section of standard diamond wheels varies from 1/32 to ¼ inch. Actually it is better economy to use the thicker sections wherever possible. A ⅛ inch section, for instance, contains four times as many carats of diamonds as the thinnest section, and does four times the work. But the cost of one ⅛ inch section is far less than its equivalent of four 1/32 inch sections.

Why? Because in the first instance you pay for only *one* basic wheel shape, or "preform" and in the second you pay for four! Thus you save money by specifying the thicker diamond sections. The table above shows actual savings in a few typical cases.

By buying wheels with thicker diamond sections you save more than your *own* money. You also help conserve essential war materials and labor.

We urge you to take advantage of this saving, and thus also cooperate with us in conserving time and materials vital to our mutual war effort.


Construction of a Diamond Wheel for Side Grinding
Construction of a Diamond Wheel for Peripheral Grinding
X Dimension Shows Thickness of Diamond Section
SIDE GRINDING
PERIPHERAL GRINDING

CARBORUNDUM

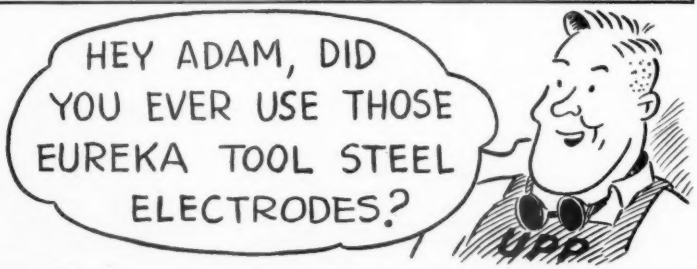
THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

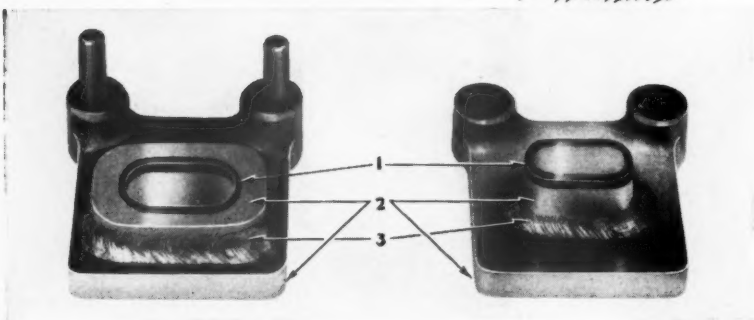
REG. U. S. PAT. OFF.

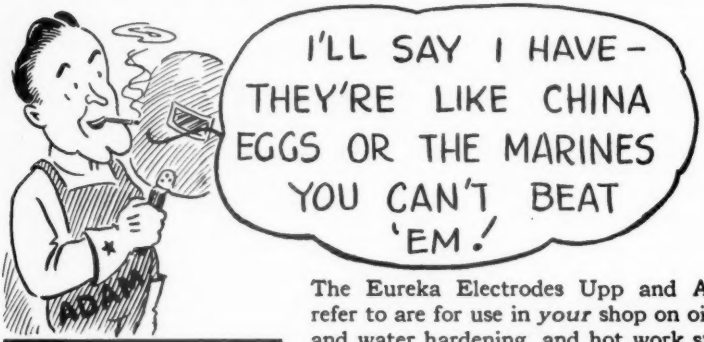
Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

UPP and ADAM *Broadcast No. 1002* •• *by* Mason-Hahn







The Eureka Electrodes Upp and Adam refer to are for use in *your* shop on oil, air and water hardening, and hot work steels. We also furnish alloy rods for drawing and forging dies, etc. For further information about Eureka Electrodes please wire or write for our catalog describing in detail the work that can be performed with this type of electrode.

Don't forget our "Suttonizing" Process by which we reclaim by welding all high speed steel tools such as Reamers, Broaches, Taps, Form Cutters, Drills, Hobs, Lathe Centers, Turning Tools, End Mills, etc.

WELDING EQUIPMENT & SUPPLY CO.
226 Leib Street • DETROIT, MICHIGAN

American No. 2
PLAIN MILLING MACHINE

for
SPEED, ACCURACY
AND VERSATILITY
in
ARMAMENT
PRODUCTION

Infinite Spindle Speeds—23 to 500 r.p.m.

Standardized Spindle Nose. Spindle heat treated chrome-nickel steel with No. 40 taper.

Motor in Base Drive. 3 hp D. S. Vari-Drive motor. Twin-Disc Duplex Machine Tool Clutch.

Heavy Rugged Construction. Heavily ribbed, positioned column houses motor drive and power shafts.

PROMPT DELIVERY

Spindle is heat-treated chrome-nickel steel and runs in heavy phosphor bronze bearings compensated for wear and equipped with alemite lubrication fittings. Standardized flange spindle nose has No. 40 taper.
Controls for speed and feed are centrally located for ease of operation.

Table working surface	46"x10¼"
Longitudinal power feed	25"
Transverse power feed	9"
Vertical hand feed	19"
Max. distance spindle to table	19"
Number of geared feeds	16"
Range per spindle revolution	.005" to .212"

WRITE FOR FOLDER

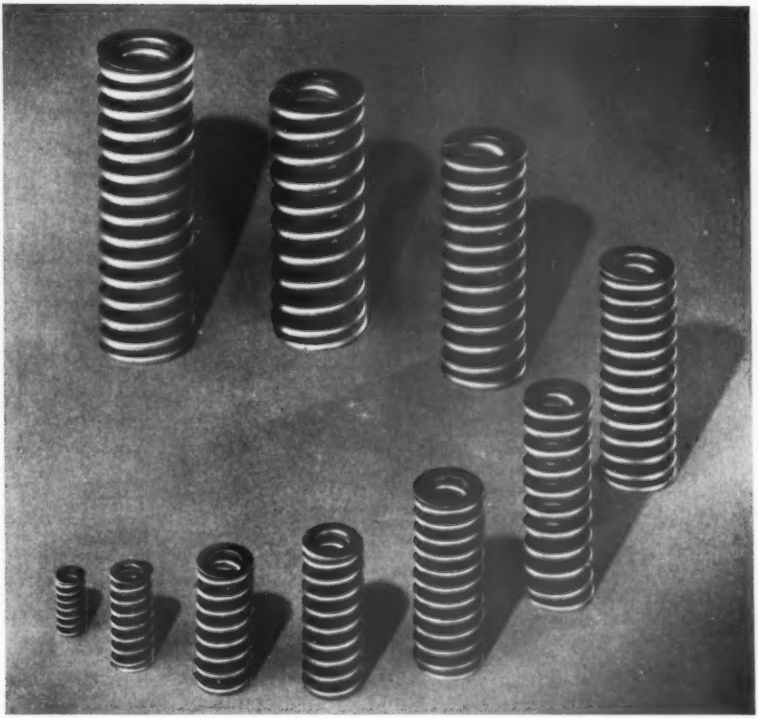
J. L. LUCAS & SON, INC.
BRIDGEPORT CONNECTICUT

ARMY
E
NAVY
And now . . .
Three flags wave over all Ex-Cell-O plants today . . . the Stars and Stripes, as always, the first U. S. Treasury "Bull's-Eye," and now—the coveted Army-Navy "E" . . . each a badge of honor, a medal for distinguished service to the Nation. * * * Exceptional achievement in the production of war materials early earned Ex-Cell-O the "E" pennant (for instance, every plane made in the United States, no matter where its ultimate destination, has precision parts made on Ex-Cell-O machines). * * * The "Bull's-Eye" flag signifies that Ex-Cell-O was the first firm in the United States where more than ninety per cent of the employees agreed to put ten per cent or more of their pay into War Bonds. * * * Flying proudly alongside Old Glory, these two pennants proclaim the unified determination of Ex-Cell-O's many thousands of workers and the management . . . to promise solemnly to America's gallant fighting sons that, as it always has, so Ex-Cell-O always will, back them up with everything it's got!
EX-CELL-O CORPORATION
1200 OAKMAN BOULEVARD • DETROIT

XLO

EX-CELL-O MEANS PRECISION

EX-CELL-O MANUFACTURES PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DIESEL FUEL INJECTION EQUIPMENT, R. R. PINS AND BUSHINGS, DRILL JIG BUSHINGS, PRECISION PARTS



DIE SPRINGS IN STOCK FOR ALL PRESSES • • •

FREE! WRITE FOR YOUR COPIES

New Muehlhausen Die Spring Folder describes and prices 206 sizes of die springs for high speed, regular and heavy duty presses.

Muehlhausen Die Springs are available in three types—Series "S" for high speed presses; Series "M" for regular speed presses; and Series "HD" for heavy duty presses. Over 200 sizes are stocked, ranging from 1 to 15 inches in length and exerting pressures from 80 to 3000 lbs. Each size and type is specially designed to meet the rigorous demands of die work. Muehlhausen's complete stock assures you of immediate delivery.

Muehlhausen Spring Corporation
875 Michigan Ave., Logansport, Ind.

Name_____

Address_____

City_____

MUEHLHAUSEN SPRINGS

EVERY TYPE AND SIZE

Mass Production of Precision!

SEBASTIAN TYPE H LATHES

Modern in design and built with extreme precision, Sebastian Type H Lathes are designed to give long, dependable, trouble-free service.

Many features contribute to the accuracy and efficiency of Sebastian Lathes. The use of Timken anti-friction bearings on all shafts in headstock, including the spindle, results not only in accuracy but also in a power increase of 15% to 20%. The wide range of feeds and speeds instantly available permits maximum cutting tool efficiency and close tolerance production. Centralization of all controls reduces operator fatigue and lowers the probability of error. Oversized heat-treated, hardened and shaved steel gears in the headstock assure quiet operation.

★ ★ Write for complete details. ★ ★

SEBASTIAN · PRECISION IS OUR BUSINESS ·

THE SEBASTIAN LATHE COMPANY

P. O. Box 1017-E Cincinnati, Ohio, U. S. A.

EARLY DELIVERY

MOREY 8" VERTICAL SHAPER

EQUALLY EFFICIENT IN YOUR TOOL ROOM OR MANUFACTURING DEPARTMENT

FEATURES:

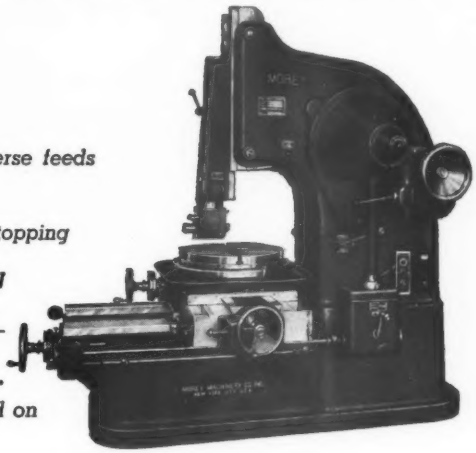
PRECISION

POWER *rapid traverse feeds in all directions*

BRAKES *for quick stopping*

BIJUR LUBRICATION

TIMKEN BEARINGS— *Bull gear mounted on Timken bearings • Roller table mounted on Timken bearings*



CUTTING STROKE *and* ***FEED*** *instantly available by single levers • Stroke immediately adjustable, automatically locked*

MODERN DESIGN—*easy to operate—built to highest standards • Finest materials*

POWERFUL—*yet finger-tip control throughout*

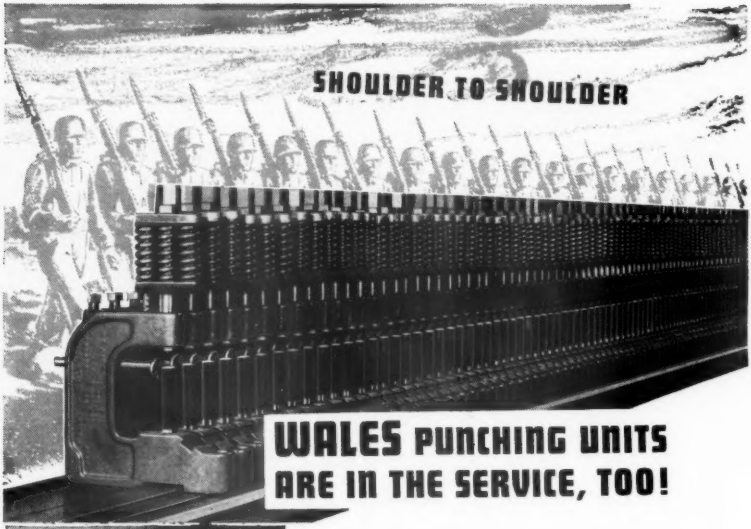
WE ALSO BUILD THIS SHAPER IN 12" AND 14" SIZES

ASK FOR CIRCULAR No. 726

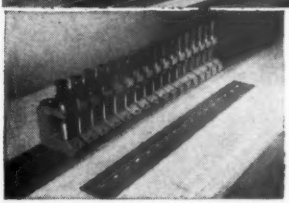
DESIGNED AND BUILT BY

MOREY MACHINERY CO., INC

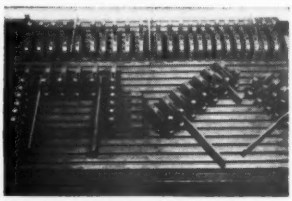
410 BROOME STREET • NEW YORK, N. Y.



WALES PUNCHING UNITS ARE IN THE SERVICE, TOO!



Gang of Wales Units on press brake rail. Note oblong holes.



Showing 3 set-ups of Wales Units on one T-slotted plate.

FEATURES OF WALES HOLE PUNCHING UNITS

Nothing is attached to press ram.
Self-contained punch and die holder.
Punch and die always in perfect alignment.
Each individual holder can be removed or reset on rails, templates or T-slotted plates instantly.
Punches, dies, guides, and strippers can be removed from holders quickly.
Interchangeable punches and dies punch various sizes and shapes with the same holders.
Scattered and straight line patterns of holes can be punched with Wales Units.

No longer are valuable months required for tooling up to perforate sheet metal on mass or short run production schedules. Wales Hole Punching Units are always ready to punch more holes faster by simply locking them into position on the bed of presses or press brakes. It's only a matter of minutes.

Rapid change-overs of patterns increase production and speed delivery of vital war materiel to all United Nations fighting fronts. That's why leading metal fabricators are using Wales Hole Punching Units in their production for victory program. Yes, Wales Units are today's Production Line Soldiers.

All the exclusive die developments built into Wales Punching Units are in keeping with the progressive Strippit policy—"There's Always Something New in the Wales Line."

Keep pace and keep posted by writing today to—

THE STRIPPIT CORP.

345 Payne Avenue
NORTH TONAWANDA, N. Y.
George F. Wales, President

Specialists in Punching and Notching Equipment

Four hardened gears are ground at the same time, insuring identical thickness and great savings of time.

DoAll MIRACLE GRINDER

This ultra-modern precision grinder is preferred in hundreds of busy plants today because of its super accuracy. The mirror-like finish obtained on the DoAll is so smooth and exact that you can actually "wring" two flat surfaces together.

Work is visible at all times, being perfectly lighted by a cool, fluorescent bulb located under the wheel cover.

Adaptable to either wet or dry grinding, the DoAll Grinder comes in two sizes, with 7" or 10" wheel.

Write for interesting literature about this better grinder.

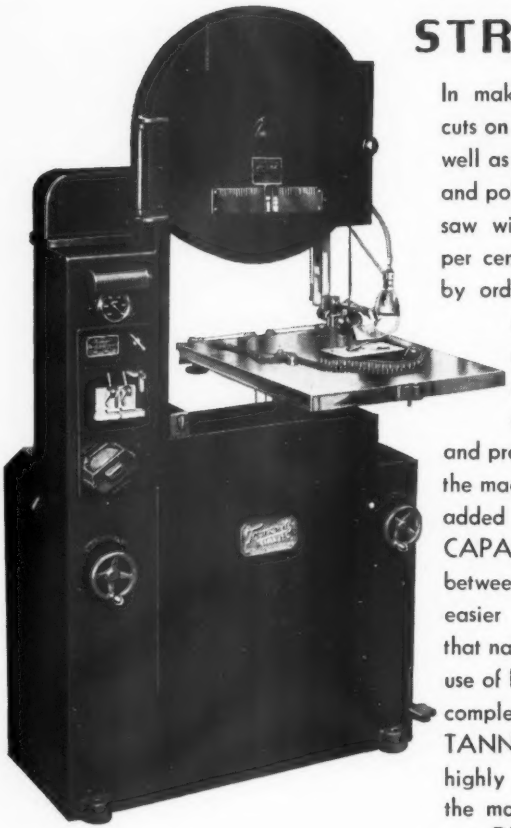
6 REASONS WHY THIS GRINDER IS THE BEST

SAVAGE TOOL CO.

DEPT. TD, SAVAGE, MINN.

Tannewitz DI-SAWS

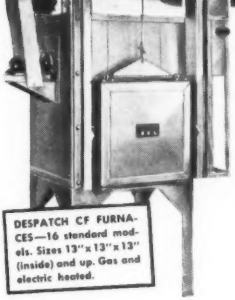
have LARGER CAPACITY, saw *Easier*, STRAIGHTER



In making inside and outside cuts on dies, tools, jigs, etc., as well as inside and outside filing and polishing, the modern die saw will save upwards of 70 per cent of the time required by ordinary methods and reduce costs proportionately. Don't overlook this great opportunity to step up both production and profits. But be sure to get the machine that gives you the added advantage of EXTRA CAPACITY (a full 24 inches between the blades) and the easier and straighter cutting that naturally follows from the use of larger wheels. Get the complete facts concerning the TANNEWITZ M-24, the most highly developed die saw on the market. Simply write for our DI-SAW Bulletin. Also describes larger DI-SAWS for special applications.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN

HOW TOOL SHOPS ARE *Winning the War* OF PRODUCTION



DESPATCH CF FURNACES—16 standard models. Sizes 13" x 13" x 13" (inside) and up. Gas and electric heated.

DESPATCH SPEEDY HEAT TREATING FURNACES FOR TOOLS, DIES, PRECISION PARTS

DESPATCH POT TYPE FURNACES — 32 standard models. Basket sizes, 8" diameter x 12" deep, and up. Gas, oil, or electric heated.

Heat treatment of metals must be speedy and flexible to handle faster machine output. Furnaces must have absolute uniformity and temperature control. Furnaces must be handy and easy to operate.

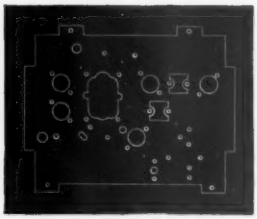
Despatch furnaces incorporate all of the features that are vital to win your production battle. Investigate Despatch furnaces for heat treating in your tool shop.

Write today **for Bulletin No. 81-0 (Pot Type Furnaces) and Bulletin No. 83-0 (CF Furnaces).**

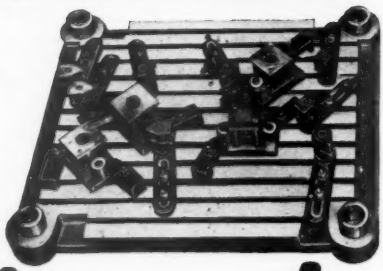
DESPATCH
OVEN COMPANY MINNEAPOLIS, MINNESOTA

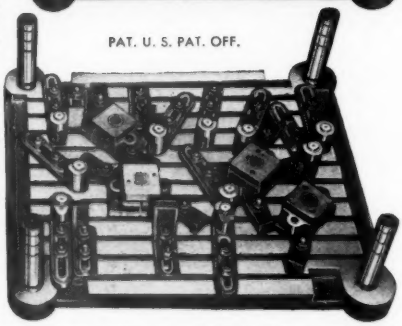
GET INTO PRODUCTION QUICKER WITH WHISTLER ADJUSTABLE DIES

Adaptable to any type press for fast set-ups and quick change-overs on PERFORATING, NOTCHING and PIERCING operations.



Typical example of perforated and notched piece produced by a Whistler Adjustable Die Assembly.

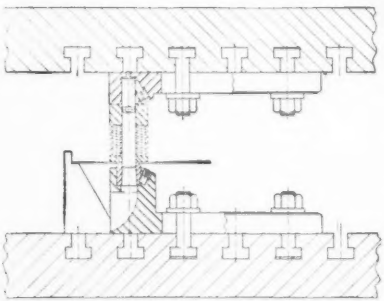




PAT. U. S. PAT. OFF.

ABSOLUTE PRECISION

Once locked into position, die and punch holders "stay put." Compact design offers minimum perforating centers of ⅞ inch—more perforations in less operations. Full range of sizes for all types of work.



Side view showing construction detail of a U-50, 0" to ½" Whistler Adjustable Perforating Punch and Die Assembly.

COMPLETE INTERCHANGEABILITY

Machined to tolerances of .0002" all parts are interchangeable. Can be quickly rearranged for different set-ups... often without taking out of the press.

Whistler dies, tools and special machinery have been answering production problems—*for over 25 years, thru two wars*—in the nation's most important factories.

S. B. WHISTLER & SONS, Inc.

752-756 MILITARY ROAD BUFFALO, N. Y.

We can deliver

within a few days

STANDARD *Plug* GAUGES!

IN INSTANCES where there are vitally important rush orders, the Turner Gauge Grinding Company can deliver standard plug gauges within a few days after your order is received. We carry in our stock at all times standard plug gauge blanks, turned up and hardened, ready for finishing and final inspection.

If this promise sounds unbelievable in these times, try us today with a small order. Wire, now, if you really need standard plug gauges in a hurry!

ONE of the reasons why we can *make* and *keep* delivery promises is our new home designed solely for the manufacturing of precision gauges. It is modern in every detail, contains over 10,000 feet of floor space and is equipped with machines and inspection instruments of the latest design. Under such conditions, our skilled operators can produce finer work and still maintain wartime production schedules.

WIRE OR SEND THIS COUPON TODAY!

Turner Gauge Grinding Co.
Ferndale, Mich.
Gentlemen:
Please rush price lists today.

Name.....

Street.....

City.....State.....

☐ If enclosing order please check here

TURNER GAUGE GRINDING COMPANY

2624 HILTON ROAD • • • • FERNDALE, MICH.

How Monarch delivers a mile of Lathes per month

The exact number is a military secret. But if you use the old method of placing them "end to end," they'll stretch out a mile, almost any month. And they're all going into the fight for Victory.

Our production in 1942 is double that of 1941, four times that of 1940. Several reasons account for this, which are listed briefly at the right.

If you can use our experience to increase your production, we are anxious to share it. We have no secrets about *anything* that will help bring Victory faster.

MONARCH LATHES

COVER THE TURNING FIELD

Below are some of the more important moves we made, many of them long before Pearl Harbor, to produce Monarch lathes faster:

1. *Simplified line with fewer sizes*—concentration on sizes and types most needed in War production.

2. *Redesign of unit parts*—to permit faster production, and to reduce quantities of critical materials.

3. *Better job analysis*—intensive study of every part, to turn it out the fastest way with existing equipment.

4. *Expanded plant facilities*—more space, more machine tools, but a relatively low percentage when compared to our rate of production increase.

5. *Better tooling*—to fit the job, and with almost 100% use of tungsten carbide tools.

6. *Better plant layout*—to avoid back tracking, useless handling of materials and processed parts.

7. *Reduced "waiting time"* for materials by careful scheduling, which also reduces inventories on critical materials.

8. *Supervisor training*—continuous classes to develop competent supervisors needed to guide heavy influx of new workers.

9. *Vestibule school*—for every new man and woman employed, in which they are observed, trained and then placed where they will be most useful.

10. *Three balanced shifts*—with 7-day operation to get the most production out of every machine in our plant.

11. *Loyalty and patriotism* of every employe, who knows the lathes they build turn out implements and munitions for Victory. They know this is *their* fight, too, and *they're doing the job.*

Realizing the value of *time*, we have sacrificed everything to it, except one basic principle. There shall be no letdown in the quality and accuracy of Monarch lathes, for this means only ultimate *waste* instead of *saving.*

THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

The speedy way to

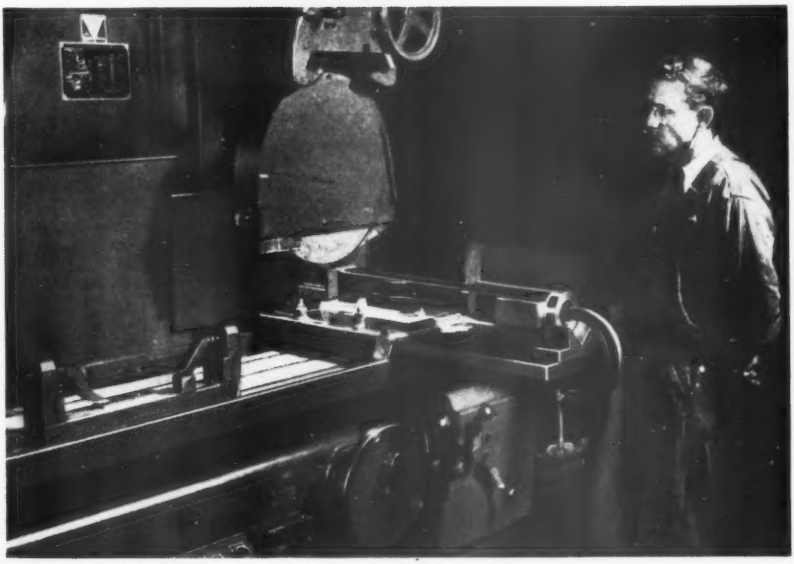
GRIND

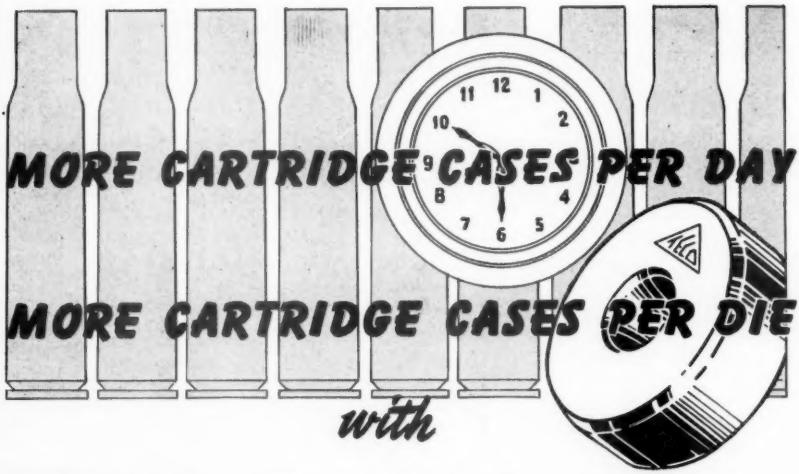
gun parts accurately

Specifications for various parts for this type Anti-Aircraft Gun call for *extreme* accuracy . . . production demands *extreme* speeds . . . and Thompson Grinders fill the bill to perfection! Thompson Grinders, available in a number of sizes and models, feature the right setup and operation speeds needed for war production of this nature, ofttimes speed-grinding to limits of less than .0001". Bulletins list all features in detail. Write to the Thompson Grinder Company, Springfield, Ohio.

Below: Setup for grinding operation on a Thompson Type C Hydraulic Surface Grinder. The parts are breech casings for Anti-Aircraft Guns (illustrated at the left). A battery of Thompson Grinders is applied to continuous, speedy and accurate operations of this type of various gun parts in this midwestern plant.

Thompson GRINDERS





TECO Carbide Dies

YOU can't stretch a day into more than 24 hours. But you can make those 24 hours more productive by equipping your cartridge case machines with TECO Carbide Dies.

The high-speed, long-run capacity of TECO Carbide Dies has boosted cartridge case output in leading munitions plants throughout the country . . . while holding all on-size, improving quality of finish and eliminating rejects. Moreover, TECO Carbide Dies will give you longer service because their rigidly controlled uniformity, density and hardness reduce wear and friction to a minimum, thus lengthening die life.

Let TECO Carbide Dies stand on their own merits. Make a test run in your plant and compare their output with that of your present dies. TECO Carbide Dies sell themselves!

Draw Dies	*Necking Dies*
Sizing Dies	*Tapering Dies*
Bullet Dies	*Swage Dies*

TUNGSTEN ELECTRIC CORPORATION
574 39th STREET • UNION CITY, NEW JERSEY
Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Representative: Architects and Builders Bldg., Indianapolis, Ind

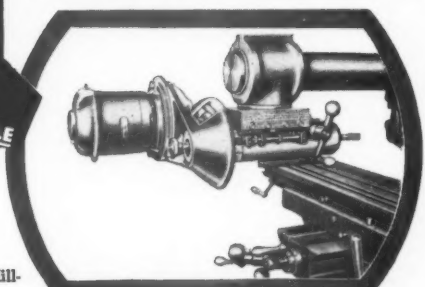
TECO *Pioneers in Tungsten Carbides for over a Quarter Century* **CARBIDE DIES**

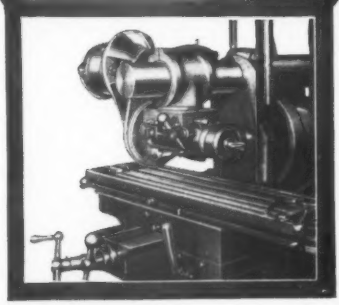
New HALCO UNIVERSAL HEAD

for High Speed MILLING, DRILLING, BORING and COUNTER BORING

Five Speeds 350 to 2900 R.P.M. Also 10 speeds 125 to 2900 R.P.M. available at extra cost.

FOR HIGH SPEED MILLING, DRILLING, BORING AND COUNTER BORING IN ANY ANGLE





THE Halco Hi-Speed Universal Milling Attachment has proven its importance in building tools, dies, jigs, fixtures, wood and metal patterns and other machine products. Its 4-inch vertical travel permits many milling, boring and facing operations in one setup, a factor of convenience to which is added the advantage that the unit can be easily mounted by one man, it weighing only 90 pounds. Each head is unconditionally guaranteed for six months.

DEFINITE DELIVERY

(Designers and Builders of Fine Machine Tools)

SEND TODAY FOR FOLDER

AJAX ENGINEERING & MFG. CO.

MANUFACTURERS OF HALCO PRODUCTS

14234 BIRWOOD AVE., DETROIT, MICH.

New SOUTH BEND TURRET LATHES

Designed for the rapid machining of small duplicate parts, the new Series 1000 South Bend Turret Lathes are especially adaptable to second operation work. Their speed, accuracy, power and versatility make possible rapid production without sacrificing either efficiency or precision.

Features that contribute to the versatility and efficiency of these lathes are: the smoothly operating handlever bed turret, the handlever cross slide with double tool blocks, the compound cross slide with power longitudinal feeds and power cross feeds for the universal carriage, forty-eight thread cutting feeds driven by a precision lead screw, and a wide range of spindle speeds.

Standard extras simplify tooling this lathe for war production and make it easily convertible to other work when peace comes.

Series 1000 Turret Lathes

The Series 1000 Turret Lathes have a 1⅜" spindle hole, 10⅛" swing over bed, and 1" maximum collet capacity. They are made in bench and floor types—with or without coolant equipment. Standard equipment includes quick change gear box, power feed universal carriage, handlever cross slide, compound rest cross slide, and handlever bed turret. Standard extras (not included in prices of lathes) include 4-way turret tool block, tailstock, collet attachment, taper attachment, thread dial indicator, and micrometer carriage stop. Write for Bulletins 1002 and 1004 which contain complete information and specifications.

SOUTH BEND LATHE WORKS

SOUTH BEND, IND. *LATHE BUILDERS FOR 35 YEARS*

SHIRT-SLEEVE *Trouble Shooters!*

We're up to our necks in trouble these days — that is, other companies' troubles! We've made *their* war production problems *our* problems, and are helping to solve them with a speed and efficiency born of long experience.

Sometimes this involves designing special jigs, fixtures, dies or machinery — sometimes rearranging plant layout and routing.

But whatever the requirements, skilled McKinney men — engineers, designers and tool makers — team their abilities and experience to effect maximum production in record time.

Our recently expanded facilities and increased personnel now enable us to offer this helpful engineering service to more companies. May we quote on your requirements?

DEPEND UPON McKINNEY FOR:

- ★ Design and manufacture of dies, jigs, fixtures
- ★ Process Engineering
- ★ Tool Designing
- ★ Plant Layout and Routing
- ★ Product Engineering
- ★ Machine Designing

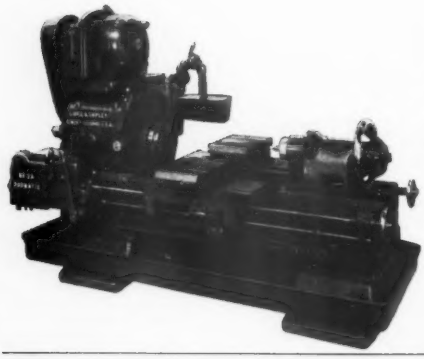
McKINNEY

TOOL & MANUFACTURING CO.

1688 ARABELLA RD. CLEVELAND, OHIO

"DESIGN ENGINEERS FOR TWENTY YEARS"

Duomatic Lathe for Turning and Facing Operations



THE No. 3A Duomatic is an automatic lathe for the advantageous use of multiple tools in turning and straight and angular facing operations. It is particularly adapted to quantity production of lathe work arranged between centers, on an arbor, or in suitable chucks or fixtures.

As its name implies the Duomatic is dual in character, having a complete front carriage and tool slide and a complete rear carriage and tool slide, each independently actuated from its own feed screw. The feed and traverse mechanism provides rapid forward and return traverse and a graduated dial for determining the length of power forward traverse.

A separate clutch lever enables the operator to set up the required cycles by hand through rotation of a hand wheel at the tailstock end of each feed screw. Dual control levers enable the operator to start the cycles independently or simultaneously from the front or from the rear of the machine.

The Lodge & Shipley Machine Tool Co., Dept. 3D, Cincinnati, O., has available an attractive Catalog No. 601 further describing and illustrating the Duomatic.

"Metalurgency," a new article on critical alloy conservation, appears on page 48.

Sharp Tools Wear Longer . . . Do a Better Job

SAVE YOURS with

QUEEN CITY GRINDERS

BALL BEARING BENCH, PEDESTAL and DISC TYPES

Tool grinding is only one of the many jobs handled efficiently by Queen City Grinders.

They are built in a complete range of sizes in bench, pedestal and heavy duty box type bases in units from 1 H.P. to 10 H.P.

These grinders are powerful—sturdy units equipped with two Carborundum wheels, one coarse, one fine—safe enclosed wheel guards with built in exhaust—Allen Bradley push button switch with overload protection—adjustable and safe work rests—tool tray—water pot—adjustable, shatter proof, clear glass eyeshields.

All Queen City Grinders come fully equipped with grinding wheels, ready for immediate use.

The initial cost is also comparatively lower than most grinders.

QUEEN CITY DEALERS at your Immediate Service

Geo. M. Bernstein & Co.	Chicago, Ill.
Indianapolis Machinery & Supply Co.	Indianapolis, Ind.
James W. George Machinery Co.	Detroit, Mich.
Eichman Machinery Co.	Kansas City, Mo.
McDonald Machinery Co.	St. Louis, Mo.
Cincinnati Machinery & Supply Co.	Cincinnati, O.
Hess-Schenck Co.	Cleveland, O.
E. W. Smith Machinery Co.	Columbus, O.
C. H. Gosiger Machinery Co.	Dayton, O.
Elyria Belting & Machinery Co.	Elyria, O.
State Machine Tool Co.	Milwaukee, Wis.

QUEEN CITY MACHINE TOOL CO.

218 EAST SECOND ST. CINCINNATI, OHIO

THE NEW LABOR ARMY LIKES THESE MACHINES

These "minute women of '42" by the hundreds of thousands are setting a smooth fast pace on batteries of Delta low-cost Drill Presses, Grinders, Saws and other Delta machines. A few months ago they didn't know the difference between a drill press and a punch press —a cut-off machine or cut-off switch. Now they are handling their machines like veterans and meeting production quotas with ease.

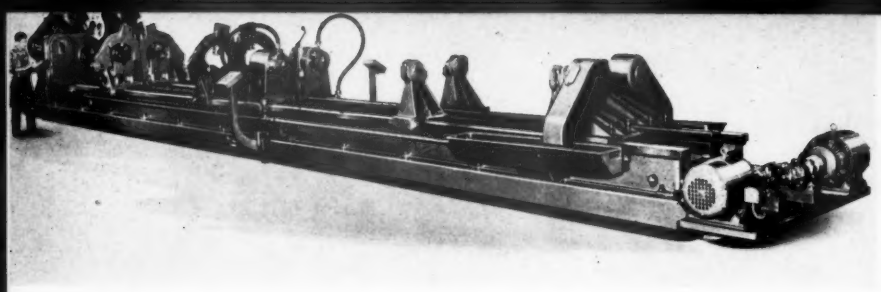
Management likes these machines too, because "breaking in" women and unskilled labor can be done in an unusually short time. Most important, skilled mechanics are released for more difficult work.

DELTA DESIGN Always Offers You These Advantages

Low First Cost
Low Maintenance Cost
Economical Operation
Reduced Labor Costs
Greater Flexibility
Portability

DELTA
MILWAUKEE

Send for "TOOLING TIPS" showing how other manufacturers are taking advantage of the many features of DELTA-Milwaukee machines. Also for latest complete catalog. Get in touch with your Delta Industrial Distributor or write to The Delta Manufacturing Company, 612-M E. Vienna Ave., Milwaukee, Wis.



New Machine Drills and Bores Two Holes Simultanously

THE new 445 Independent, Two Spindle, Deep Hole Drilling and Boring Machine is designed to drill or bore two parts simultaneously in completely independent cycles. Each work-piece is driven by independent headstocks and is supported by separate steadyrests. The tools are fed by hydraulically actuated slides.

The machine base, with three ways running full length, is cast in two sections. The head section of the base has T-slots milled into the center way for clamping the headstocks and the steadyrests to the ways. Other sliding members are clamped to the outside ways.

By loosening the T-slot bolts and the clamp gibs, each headstock can be positioned at any place along the head base.

The steadyrests are of the three-point type, having adjustment on each of the rollers. The screw adjustment for each of the rollers permits the handling of the work from 5" minimum to 16" maximum outside diameter. The top portion of each steadyrest is hinged to facilitate convenient handling of the work-piece when loading and unloading.

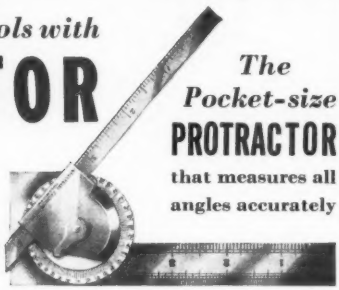
The whip supports are positioned midway between the tool holder and the tailstock at the beginning of the work cycle. Springing of tool shanks at the start of the work cycle is prevented by the guide bushings in the whip supports.

Further information may be obtained from W. F. & John Barnes Co., Dept. TD, Rockford, Ill.

Save your Tools with

XACTOR

Insure Greater Efficiency



The Pocket-size

PROTRACTOR

that measures all angles accurately

NOW INDISPENSABLE TO THE CHIEF ENGINEER, RESEARCH ENGINEER, TOOL GRINDER, MACHINIST

!

XACTOR measures directly any surface angle, large or small, such as are ground on cutting tools, without the aid of attachments.

Quickly measures tapers on shallow blind holes or tooth angles on broaches, simply by sliding the Arm to suit your conditions.

Degree-graduations are arranged so the component angle is read directly, as well as required angle.

No clamps, no projecting set-screws, or other clamp-devices. Fits your vest pocket nicely. Ready for instant use.

Write for fully illustrated circular.

INDUSTRIAL ENGINEERING CO., Inc.

141 West Jackson Boulevard, Chicago, Ill.

Can be purchased at Machinists' Supply and hardware dealers in United States and Canada.

Announcing the NEW **GORTON** **SPIT-FIRE**

ELECTRIC ARC ETCHING MACHINE

VERSATILE—DOES LIGHT OR DEEP ETCHING JOBS LIKE THESE—*Large Photo at Top*—Close-up of Etcher applied to a High Production Job. Parts are ball sockets. Each part completed in 15 seconds—240 per hour. *Other photos above* show adaptability to etching an almost endless variety of sizes and contours, inside Cylinders, Cavities, on V-Blocks, Gages, Gears, Rods, Hardened Pins, etc.

For Accurate HIGH PRODUCTION ETCHING

and Permanent Identification of Parts, Tools, etc.

A NEW GORTON DEVELOPMENT—"Spit-Fire" Electric Arc Etching—provides the answer to urgent war plant demands for an All-Purpose Production Etcher which *deeply etches hardened parts without burr in minimum time.* Now in use by largest companies.

MARKS GOODS IN FINISHED STATE at speed of 120 arcs per second with pantograph machine accuracy. Produces an etch improved in legibility, clean-finish and uniformity. Most efficient on highly polished or ground surfaces, large or small, or on delicate parts such as .0015" Feeler Gage stock.

PERMANENTLY ETCHES—LIGHT OR DEEP from .0001" to .003" deep, and from .0075" to .015" wide—on soft to hard metals, including hardest steels—ANY SHAPE, on flat or irregular surfaces or any curvatures—*without Forming Guide.* Automatically follows contours with vertical movement up to 3/8".

SIMPLE OPERATION—QUICK SET-UPS—Uses unskilled operator, man or woman. Etching is precision-controlled through pantograph tracing from master. Usually no preparation of work needed. Requires no acid, no pressure, stress or strain. Overcomes problem of metal fatigue—no fissures, no flaws result. Operates on 110 to 120 volts, 60 cycles AC only. Etching voltage, 3 to 9 volts. Current consumption 25 watts, maximum.

PRESENT DELIVERIES 2 to 4 WEEKS

AVAILABLE TWO WAYS
Complete Etching Machine
or
Portable Etching Unit for Other Machines

MODEL A-E ETCHING MACHINE

Equipped with complete "Spit-Fire" Etcher Unit. A simplified Gorton Pantograph machine, developed for best results with the "Spit-Fire" Etcher. Has rugged column and table. Etcher head attached directly to pantograph. Choice of 3:1 or 6:1 fixed ratio pantograph. (Adjustable Pantograph providing 3:1 to 100:1 optional at extra cost.) Model A-E Etching Machine, with "Spit-Fire" Etcher Unit. Price **$775**

ETCHER HEAD AND CUTTER SPINDLE INTERCHANGEABLE—The "Spit-Fire" Head can be installed or removed in a few moments. An ideal set-up for high production work, the tool room, or those odd etching jobs in small shops.

PORTABLE ETCHER UNIT

Available separately for those already owning a pantograph machine and whose work does not justify purchase of the complete etching machine above. The "Spit-Fire" Unit fits any make of conventional pantograph machine. Just remove spindle and slip Etcher shank in its place. Unit consists of Etcher Head, Control Panel with Pilot Light, Transformers, Cables, 36 Electrodes, assorted sizes—in convenient carrying case. Order No. 828-2. Price **$220**

Write for **FREE** Bulletin 1535A for Full Details

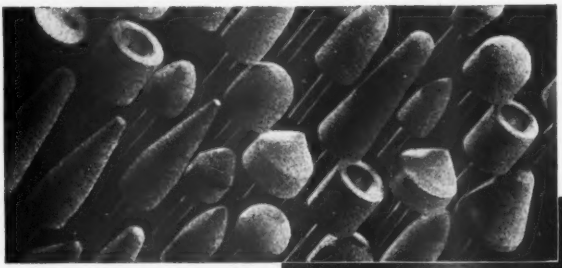
GEORGE GORTON MACHINE CO.

49 Years

1319 RACINE STREET, RACINE, WISCONSIN, U.S.A.

SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

POLISH 'EM OFF WITH



They're TOUGH *and* DO Their STUFF!

Commandos of the grinding wheel industry—the first small wheels mounted on steel shanks and leading the way today with smoother, more rapid grinding, polishing and finishing of difficult jobs.

Chicago Mounted Wheels—the result of 45 years of KNOW HOW—come in a wide range of styles on different size shanks, for use with any portable or flexible shaft grinder. Several special-formula abrasives give 150% to 300% longer service. More than 200 shapes, all mounted and rarin' to go.

HI-POWER GRINDER

A real production tool—a 3-pounder with enough power to drive a 2½" diameter wheel. 17,000 r. p. m. In case with accessories, $38.50.

LATEST CATALOG—Packed full of comprehensive information and pictures. You'll be interested. Send for copy.

TEST WHEEL FREE

If you have a grinding problem, send for a Survey blank, which you'll find easy to fill out. Upon its return, our abrasive engineers will analyze it and send you without charge the trial wheel they recommend for your particular job.

TD-11

☐ Send Hi-Power ☐ Catalog
☐ Free Wheel. Size _____

Name _____

Address _____

CHICAGO WHEEL & MFG. CO.

Makers of Quality Products Since 1896

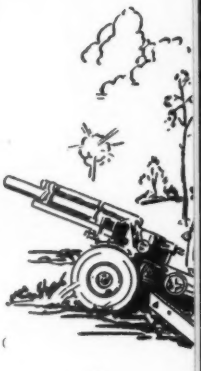
1101 W. Monroe St., Dept. TD, Chicago, Ill.

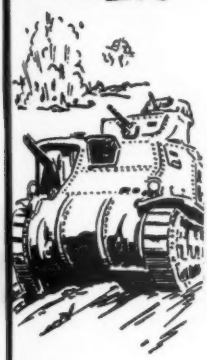
PLASTICATOR

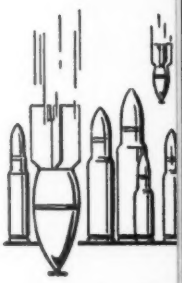
GORDON B. THAYER*
Technical Consultant

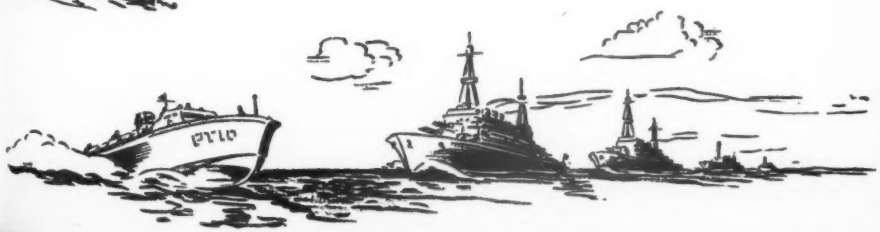
BAYONET scabbards, bomber visors, ammunition rollers, gas mask lenses, tank and jeep parts are but a few of the many war products made from plastics. The next year will see this list of plastics products used by our Armed Forces grow as the need for substitute materials increases. Tooling experts, wise in the ways of metal fabrication, will be called on to solve problems concerning plastics. Difficulties anticipated by the designer and mold maker will do much to save man-hours and materials.

The series of articles on "Loading the Injection Mold", now appearing in the Plasticator, explains many problems encountered in mold construction.









PLASTICATOR

Loading The Injection Mold

This discussion of venting and gate design for injection molds is equally important to the designer and molder.

It is important for the designer to understand problems before they arise. The molder must understand the adjustments which will correct the mold after it is made.

A RING type gate may be employed to mold a hollow cylindrical piece. The ring gate, as shown in Fig. 4, is a combination of runner and gate, which encircles a core pin and lets the material fill the cavity uniformly. This type of gate eliminates the usual weld line that would be formed if the material were introduced through a standard plain gate on one side and forced to flow around the pin and join on the side farthest from the gate. The plastics material, by advancing uniformly down the pin, produces a minimum of lateral stress tending to bend or displace the pin. When extremely close tolerances are required on concentricity and wall thickness, a plain gate introduces the material on one side of the core only, causing the material on the entering side to push the core off center. Since the core meets no balancing resistance in the empty cavity space opposite the gate this situation arises. A ring gate, or some modification of it, may often be used to avoid this difficulty.

Added expense is incurred by the use of the ring gate due to the excessive material which has to be trimmed from the molded piece. A common method of removing this excess material is accomplished by means of a small fixture. The fixture locates and holds the article, as shown at point B in Fig. 4, while the cut off is made with a high speed fine disc saw.

The disc type gate shown in Fig. 5 is useful for molding thin, flat and annular pieces. Here the sprue hole leads directly to the center of the disc. The material flows evenly in all directions and fills the cavity completely without weld lines. The location of the gate, if possible, should coincide with a hole in the finished molding. Then the cold slug, sprue, and the portion of relatively poor material at the gate can be removed, either by punching or turning. If the sprue occurs on the surface portion of the finished molding, it may be necessary to cut or grind off the sprue and polish the surface afterwards. This generally results in a blemished piece,

By Don F. Hoffman
Detroit Mold Engineering Company

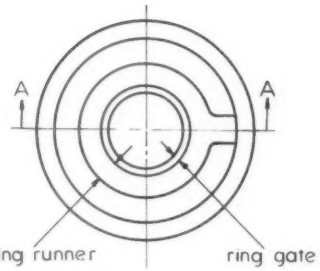
especially if molded from a translucent or from a transparent material.

A disc gate minimizes the loss of material. The molded article, due to proper mold balance, is likely to be of better quality. Fig. 6 is a photograph of small discs molded through a disc gate.

When several cavities are molded at one time, a multiple orifice nozzle may be used with sprue holes leading directly to each cavity. Another way to accomplish the same end is to employ an extra plate with a large runner connecting the sprue with the individual auxiliary sprues. This requires the mounting of the cavity retaining plate on the stationary side of the mold and part from its backing plate in order that the runner and main sprue may be removed. The molded piece remains in the movable half of the mold and is ejected in the usual manner.

Venting

When the plastics material in its softened state enters the gate of the cavity, any obstructions in the mold such as inserts and pins will cause the



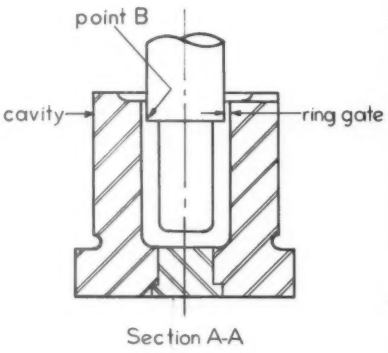


Fig. 4—Ring Gate

Fig. 5—Disc Gate

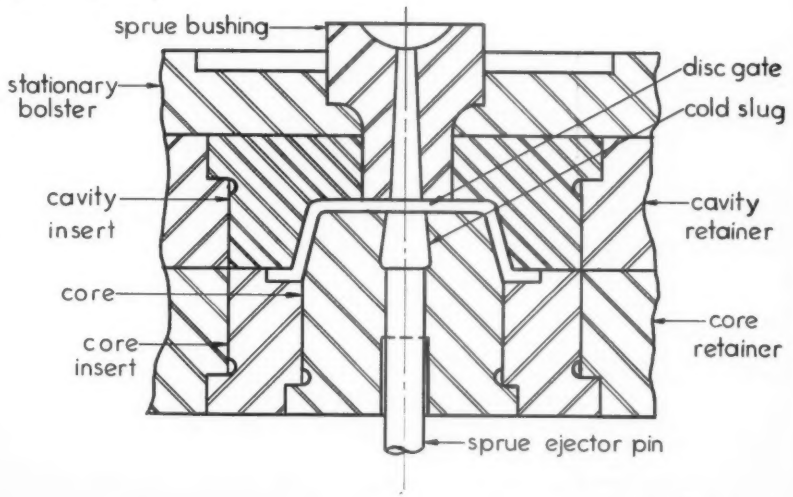


Fig. 6—Moldings made with a Disc Gate

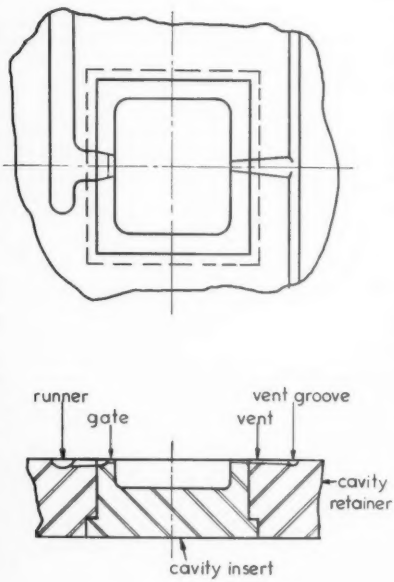


Fig. 7—Simple Venting

material to divide and chill considerably. Under favorable conditions, however, this material will meet after surrounding the obstruction and will fill the cavity completely. If the mold surfaces are ground and lapped, the mold will be practically air tight. Hence, the air that is in the cavity is compressed by the injection of the plastics material and it must escape by means of sleeves, ejector pins, or specially placed vents. If this air is not permitted to escape, it compresses and chars the material, and at the same time it prevents the cavity from filling. Inspection at the mold design and molding usually will show where venting will be required. A practical vent is a milled groove approximately ⅛" wide by $\frac{1}{16}$" deep across the face of the mold opposite the gate side located ⅜" to ½" from the cavity. To this groove then, a vent groove is run .001" to .002" deep by ⅛" wide. This vent facilitates the escape of air. The burning of the piece may occur at or near the parting line directly opposite the gate for shallow moldings. Hence, this is the most logical place for venting. Figure 7 shows a thin rectangular dished piece. When this piece is filled with plastics material the air will be forced ahead under high compression and it may cause a charred or incompletely filled piece. A vent as described above is provided to eliminate this trapped gas.

The ogival shapes or deep hemispherical shapes are difficult to vent. Figure 8 shows several ways of remedying a trapped gas condition. One way is to make a plug for the bottom of the cavity with three equally spaced vents .0005" deep at the top and at least $\frac{1}{32}$" at the bottom by ⅛" wide. An annular groove ⅛" wide by $\frac{1}{32}$" deep, as shown, helps to relieve the pressure. If this plug would mar the appearance of the molded piece, it is possible to drill a small hole .013" in diameter into the cavity with a larger hole serving as an outlet. Should any material enter this hole and break off from the piece at the time of ejection it is so small it will not be noticed. Also the plugged hole would be cleaned by the force of the next injection shot. Another way to vent the mold is to increase the sectional thickness in definite areas by grinding the core. This will provide better flow and increase the speed of flow at point D to move the trapped air toward a parting line which has a vent as explained in Fig. 7. Vent-

ing might also be accomplished by means of a movable core plug as illustrated at C in Fig. 8. The core should have a ground slip fit for about ½" and three equally spaced grooves .0005" to .001" at the front, to a $\frac{3}{64}$" at the back, by ⅛" wide. Note that the core pin is relieved. When the mold opens the core pin will act as an ejector pin. Any flash adhering to the core pin will be removed by its motion. Instead of grooves, flats not more than .001" on a side can be used with the same effect.

It is obvious that gas would be trapped in the mold cavity shown in Fig. 4 unless a vent were provided at the bottom, since the incoming material passing through the ring gate completely closes the top.

REPRINTS

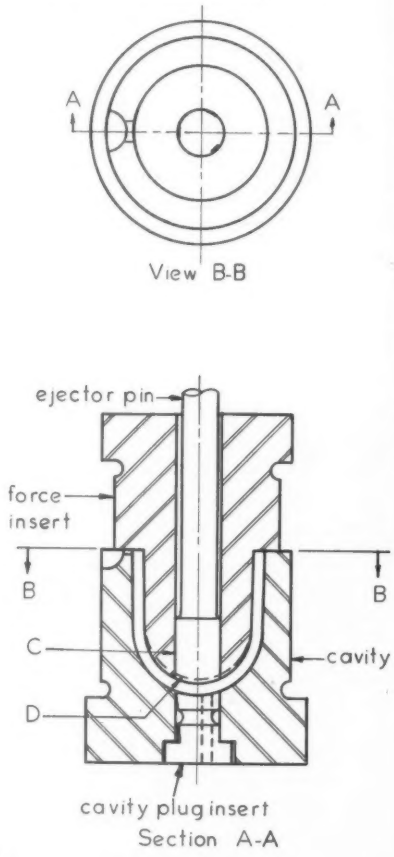
"Typical Designs for Drilling Jigs and Fixtures," a series in six parts, has been reprinted by popular demand. This series has been written by C. W. Hinman, well-known engineer and author of "Pressworking of Metals" and "Practical Designs for Drilling & Milling Tools."

Copies may be secured by writing The TOOL & DIE Journal, 2460 Fairmount Blvd., Cleveland, O. Price, 25c per copy.

The plug method is a practical way to vent this mold. The clearance between the plug and the cavity may be sufficient to allow escape of the air. The plug may be used to form a decorative design at the bottom end of the piece. In other cases it may be necessary to scratch the surface of the plug with a scriber or sharpened file to provide tiny passages for the air to leak out ahead of the advancing wall of plastics material. If this is not sufficient, a vent as shown in Fig. 8 may be required. In this application, the plug is grooved deeply and venting slots lead to the groove.

In starting a new mold in production, it is good practice to employ the cheapest and simplest principles of molding before damaging the mold beyond repair. On any charred piece, the first thing is to check the temperature of the heating cylinder as the material may be too hot. Next decrease the velocity of the flow of material by slowing down the injection ram. This will give the air a chance to escape without reaching a high temperature through compression. Check the charge of material—it may be too small. Should these fail, then it is time to alter the mold for improved venting.

Fig. 8—Venting a deep cavity



PLASTICS MOLD DESIGNING —

by Gordon B. Thayer

CONTENTS

Ten chapters on the design of typical molds for plastics — includes Methods of Mold Sinking — Suggestions on Design Procedure — Mold Building Equipment and Machinery.

●

A Six-Part Section on Mold Steels written by specialists.

●

Four-Place Shrinkage Charts.

●

Nomenclature of Plastics Molding.

Written by a Plastics Engineer of recognized ability —each chapter checked by men actively engaged in all phases of the Plastics Industry.

All drawings, by the author, are fully detailed and are representative of the latest design and molding practice.

The 100-term Nomenclature was compiled with the assistance of 14 leading authorities, at least one in every important molding center.

Price $2.50 for board cover; $2.00 for durable paper cover. Write for quantity discounts.

AMERICAN INDUSTRIAL PUBLISHERS
338 Fairmount-Cedar Bldg. - Cleveland, O.

Please send _____ copies of PLASTICS MOLD DESIGNING to:

Name _____

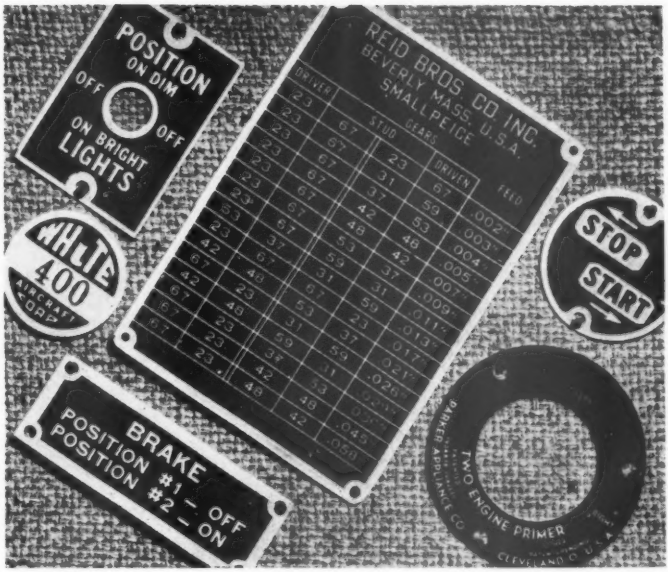
Title _____

Company _____

Street _____

City _____ State _____

Etched PLASTIC IS CARRYING ON



Etched plastic is releasing tons of metals formerly used on instruction plates, dials, scales, employees' checks, and similar items, and at prices comparable to etched metal.

Easy to read, permanently etched plastic plates can be stamped or serially numbered with the same equipment used on metal plates.

•

For complete details write { **Eastern Etching & Mfg. Co.**
Grape Street **Chicopee, Mass.**

LASTING - LEGIBLE - ATTRACTIVE - INEXPENSIVE

(Continued from Page 89)

E. Prepare joint-ends by coating with the low temperature alloy—then heat both ends separately. Precoat surface with a thin skim of alloy. Use a mild flame with a large acetylene excess, then add a small amount of flux.
F. Clamp in alignment fixture.
G. Reheat locally with mild torch with large acetylene excess until the low temperature alloy remelts, then press together.
H. Remove flash by filing.
I. Sharpen if necessary.

SALVAGING FORM TOOLS BROKEN THROUGH DOVETAIL SECTION

Low temperature building up alloy to be used with corresponding flux.

A. Broken surface on large portion of tool is cleaned with carbon tetrachloride using a soft bristle brush.

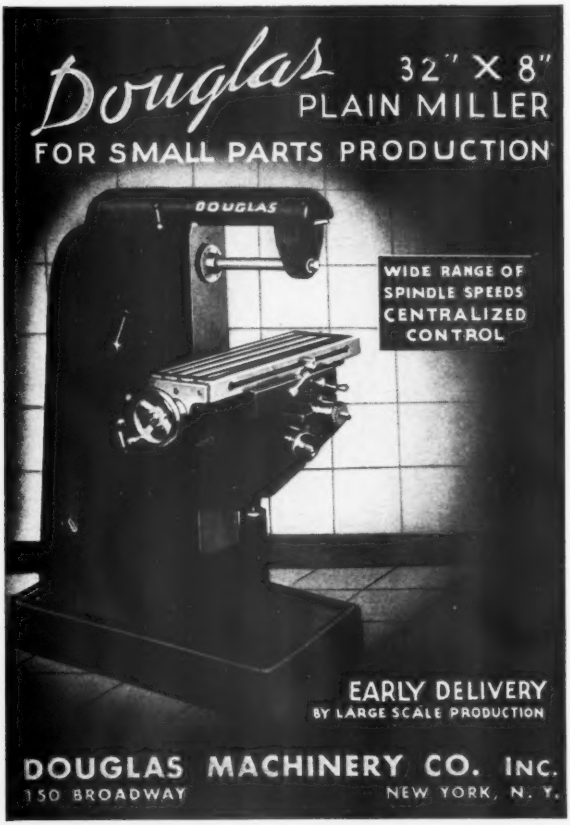
B. Prepare joint-ends by coating with flux.

C. Heat surface to beginning of dull red with a mild torch. Place low temperature, building up alloy in front of the torch and melt down. Keep torch horizontal, adding sufficient material to allow machining.

D. Machine dovetail to original size.

SALVAGING FORM TOOLS

Very low temperature welding alloy to be used with corresponding flux.



A. Clean joints thoroughly with carbon tetrachloride, using a soft bristle brush.

B. Prepare joint-ends by coating with flux. Heat edges separately with mild torch with a large acetylene excess. Precoat surface of one of the two ends to be joined with a thin skin of alloy, then add a small amount of flux.

C. Clamp in alignment fixture.

D. Reheat joint until the alloy remelts and press together.

E. Remove flash by filing or grinding.

F. Sharpen.

TIPPING TOOLS WITH TUNGSTEN CARBIDE OR STELLITE TIPS

High tensile alloy to be used with corresponding flux.

A. In many instances it is not necessary to recess the shank. A butt weld is satisfactory.
B. Clean surface with carbon tetrachloride, using a soft bristle brush.
C. Prepare surface by coating with flux.
D. Pre-place small pieces of alloy between tip and shank.
E. Use mild torch with large acetylene excess. Start heating under the shaft until beginning of cherry red is reached, then start heating top until the high tensile alloy melts freely. Exert slight pressure on the tip.
F. For very small tips, precoat tip first with a skim of the high tensile alloy. Then heat shank to dark red and put tip on place and keep heating until the alloy flows freely.

B. Prepare surfaces by coating with flux.
C. Heat the high speed steel tip first with a small torch and precoat it with low temperature welding alloy. Allow only a thin skim of alloy to flow. Wipe off any excess alloy while still hot. Add again some flux on the precoated tip.
D. Heat shaft end broadly to a dull red and then place tip in the recess. Within a few seconds the low temperature welding alloy will remelt. Then, with a rod, push tip into proper place and exert slight pressure. During this operation keep the torch moving in large circles and

(Continued on Page 126)

MAKING TOOLS WITH SMALL BITS OF HIGH SPEED STEEL ALREADY HEAT TREATED

Due to the great scarcity of high speed steel and tungsten carbide, it has been found advantageous to saw into small pieces similar to carbide tips, old high speed steel tools and to weld these on carbon steel shanks. The following procedure is suggested to avoid spoiling the heat treatment of the high speed steel:

Use very low temperature welding alloy with corresponding flux.

A. Recess the shank end to receive high speed steel tip or bit. Clean shaft and tip with carbon tetrachloride using a soft bristle brush.

WELDON ROBERTS
Brightboy
"The Soft Rubber Binder Cushions the Abrasive"
A 3-WAY PERFORMANCE
DE-BURRING - FINISHING - POLISHING
Brightboy's abrasive recedes into its rubber binder—deburring, finishing, polishing and putting on a slight radius in a single operation. Made in wheels, and in sticks, blocks, rods and special shapes for innumerable applications. Available to war industries, through recognized mill supply distributors. Write us for prices, catalog and leaflet, "Methods and Applications", if your dealer cannot give you detailed information.
BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
Newark, N. J.
U.S.A.

(Continued from Page 125)

maintain a distance between flame tip and metal of at least three inches. As soon as tip has been brought into proper position, stop heating and allow to cool slowly.

IMPORTANT: Do not heat more than beginning dull red, at which temperature this alloy is entirely fluid. At this temperature, which is approximately 1100° F, the heat treatment of the tip will not be lost.

Another problem in salvaging tools is how to replace broken teeth or edges. A satisfactory way, which involves little machining, is to machine out of a scrap tool the missing part and to join it to the defective tool. The part receiving the new piece can be slightly recessed in order to give more strength. Depending on the purpose and the strength required, select the high tensile alloy or the very low temperature welding alloy —either of which can be used in the manner previously described.

Procedure sheets are available on request from The Eutectic Welding Alloys Co., 42 Worth St., New York, N. Y.

New Safety Eye Shield

THE Martin illuminated safety glass eye shields mount right on the machine where they are always on the job. The shields are more comfortable to use and have the added advantage of being free from the annoyance of fogging under warm or moist conditions.

The shields are equipped with a laminated, shatterproof safety glass window, which is protected from chipping by an inexpensive clear glass cover lens. The sturdy cast aluminum housing completely shields lamp bulbs from the operator, concentrating all the light directly on the work at close range. This provides maximum illumination at minimum cost, entirely independent of the shop lighting system.

Martin industrial safety eye shields are available in more than twenty styles and are recommended for wherever better lighting, plus better protection, is required — with grinding wheels, metal cutting saws, broaching machines, punch presses, drill presses, lathes and millers.

W. I. Martin & Co., 711 S. Dearborn St., Chicago, Ill., will send descriptive literature and prices at your request.

SPEEDS PRODUCTION! CUTS TIME AND COSTS!

SPEEDY AIR VISE

FAST! POWERFUL! FOOT CONTROLLED!

$24

Complete with Foot Control Valve, Air Hose and Fittings

HAND FREE OPERATION!

• Foot operation leaves BOTH hands free for fast insertion and removal of work. Vise stays open or closed without constant foot pressure.

Most important vise design in years! A fast-action, hard gripping air vise that speeds production; saves time, labor and costs! Speedy Air Vise operates from air line or individual compressor, exerting a grip of 15 times air pressure! Jaw opening adjustable up to a maximum of 3 inches. Maximum travel of ½ inch assures rapid insertion and removal of work. Employs no piston, but instead a long-life, multiple-type diaphragm . . . eliminating friction loss, air leakage and slippage. Rugged, compact, low priced, it is the ideal vise for speeding up numerous operations.

Write At Once For Circular H-11

W. R. BROWN CORP., 5720 ARMITAGE AVE., CHICAGO, ILL.

(Continued from Page 52)

comparatively small item of a calibre .45 Pistol Barrel. It simply wasn't needed.

In the Springfield Rifle bolt and receiver, N. E. Steel W. D. 8620 (N. E. 8620 Steel) was gone one better by adopting W. D. 8620 "Special" which contains only ½ the Chromium and ⅔ of the Nickel.

Chromium and Vanadium have long been used in springs for their fatigue resisting qualities. Again, following the Automotive lead W. D. 9260 Silicon Manganese Steel is doing the job in Tank springs because specifications were reviewed with the Metalurgency in mind.

Many ideas are developed in war and in peace which are ahead of their time. Some are allowed to die, but the originators or developers of others stick to them until their day arrives or until resistance to them is finally overcome. Many of the conservation steps recorded in Army Ordnance are old ideas that have been kept alive by the persistence of their originators. One that has been rattling around for fifteen years now holds the center of the stage in Army Ordnance but it is too potent and too secret to be revealed.

The point is that Army Ordnance recommends to Ordnance and to Industry that minds and files be searched for all ideas that have been mislaid or forgotten or which were ahead of their time.

The Metalurgency may be summed up as follows: If ferro-alloy specifications read today as they did two years ago, we would have already reached our Production Ceiling, because there isn't enough Nickel, Chromium, Molybdenum, Vanadium, Silicon and Manganese to build our war machine that way. But they do not read that way and we have not reached our production ceiling.

If a year from today our alloy specifications read as they do today, we will have reached our production ceiling. But they will not read that way and the ceiling will not have been reached.

This is not idle optimism. This is a statement of fact.

VOLUME and SPEED
Combined with ACCURACY!
American Industry's Matchless
Formula Is
EFFICIENTLY
Supported by
DUBLIFE
REVERSIBLE
PLUG GAGES
"UPPCO LAPPED"

Double life of Gages for utmost Precision Service! *New* plug end, "Go" or "No-Go" ready when other end becomes worn. Change easily, quickly made. Tapered bronze collet locks plugs firmly in hexagonal handle. Saves time! Saves LOSSES!

ASK FOR CATALOG
Send for Catalog of full line of DUBLIFE. *Specify DUBLIFE Gages and UPPCO finish.* Other Gages of American Gage Design also shown. Write.

ORIGINATORS and exclusive manufacturers of DUBLIFE Gages and UPPCO Finish.

UNITED PRECISION PRODUCTS CO.
3516 W. Belmont Ave. Chicago, Ill.

Spit-Fire Etcher for Inaccessible Places

"GORTON Spit-Fire Electric Etching" is the name of a new, improved electric arc etching process for permanent identification of parts and tools. As a result of this Gorton development, a new, all-purpose production etching machine, which deeply etches hardened parts without burr in minimum time and handles either light or deep etching as desired simply by the turn of a dial, is now successfully handling war plant production etching requirements.

Due to the Gorton exclusive extension arm design, the Spit-Fire etcher readily handles etching in previously inaccessible places, such as inside a cylinder, cavity, along both sides of a V-block and on almost endless variety of sizes and contours such as gears, connecting rods, gages, hardened pins, bushings, collets.

The Gorton Model A-E is a complete etching machine, featuring quick set-ups and easy operation. Of importance today is the fact that an unskilled operator—man or woman—can produce legible work rapidly after reading the simple directions and with practice.

Etching is done by a tiny tungsten wire electrode oscillated vertically 120 times per second by a magnetic motor. Depth is formed by amount of current — variable by one dial control from .0001" to .003" deep. Width is controlled by the diameter of electrode selected — from .0075" to .015".

Address George Gorton Machine Co., 1319 Racine St., Racine, Wis., for complete data.

STATE

BORING AND REAMING BARS

PROMPT DELIVERIES for war work of this new high speed production tool.

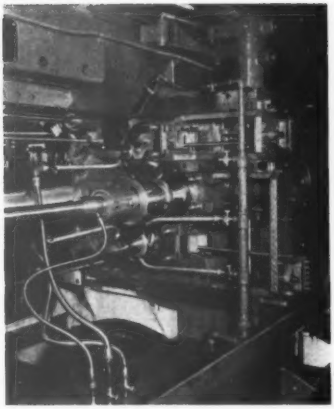
Six sizes will accommodate all diameters 1/8" to 5½" H.S.S. or tipped cutters.

Special models engineered to your specifications.

WRITE OR WIRE FOR DETAILS

STATE MANUFACTURING & CONSTRUCTION CO.
FRANKLIN · OHIO

Universal Slide Permits Wide Variety of Machining Operations



MANY improvements in performance and operation have been incorporated in the six-spindle Conomatics. Outstanding among them are: open end gear; instantaneous power feed engagement and power feed reverse, greatly reducing tool-up time.

The six work spindles of the Conomatic are mounted in adjustable anti-friction bearings of ample proportion to handle severe overloads. Spindles are driven through helical gears mounted close to the collets, eliminating chatter on the work being produced.

Each cross slide carries independent positive stops — an exclusive feature of the Cone line of screw machines. These stops insure positive work duplication. They are adjustable for each spindle position and are positioned automatically by the indexing of the spindle carrier.

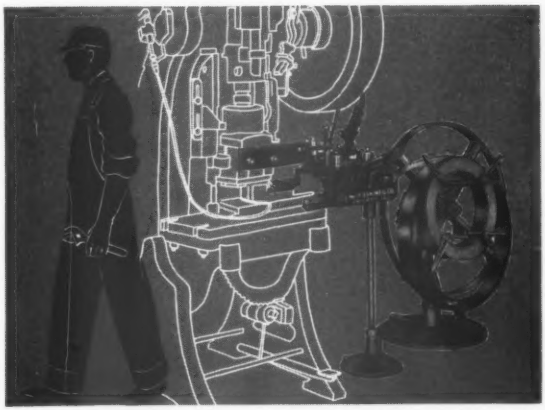
The universal slide, sometimes called the taper turner attachment, adds another cross slide to the machine, which is capable of a wide variety of machining operations such as taper undercutting, necking, backfacing. It is mounted on the top bed and operated by cams and a cam drum mounted on the projecting drum shaft at the extreme left end of the machine.

Cone Automatic Machine Co., Inc., Windsor, Vt., will send Bulletin TJ on request.

WAR PRODUCTION *rolls out faster with*

WITTEK *Automatic*

ROLL FEEDS AND REEL STANDS



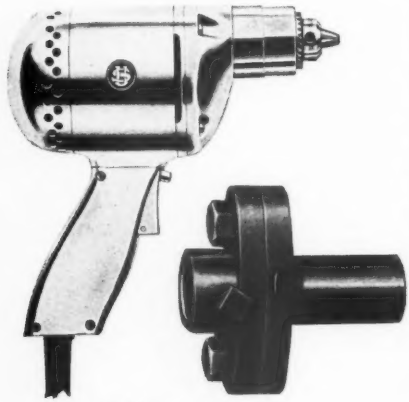
The major problem confronting industry today is increased war production. Manufacturers of metal stampings must recognize automatic feeding of coiled strip stock to punch presses as vital to the solution of their problem.

Wittek Automatic Roll Feeds and Reel Stands are designed and built by engineers with years of experience to guide them. With Wittek you can conserve man-hours and maintain new high production schedules.

★ *Write for Descriptive Catalog*

WITTEK MANUFACTURING CO., 4305 W. 24th Pl., Chicago, Ill.

PROGRESS ON PARADE



DESIGNED primarily for operations in the aircraft industry is the Model 14 ARD heavy duty drill manufactured by United States Electrical Tool Co., Dept. J, Cincinnati, O. A feature is its streamlined construction—without any protuberances from end to end, and its close coupling so that the drill can be used in cramped quarters. The rear cap over the commutator is easily removed for inspection, replacement or adjustment. The drill is air cooled to prevent overheating.

THE Ajax Engineering & Mfg. Co., 14230 Birwood Ave., Detroit, Mich., have brought out a new floating holder. These holders are made of a special alloy. A thirty-man engineering staff is maintained to discuss problems in connection with floating holders.

A NEW double-end grinder for free hand grinding of carbide tipped tools has just been announced by Willey's Carbide Tool Co., 1340 W. Vernor Highway, Detroit, Mich. The motor is of special design available for 220 or 440 volts—60 cycle, 3 phase, 3450 rpm. The accurately machined tool rest table is adjustable to all angles between 30° toward the wheel and 30° from the wheel. Table is also adjustable, with quick clamping features to compensate for wheel wear.

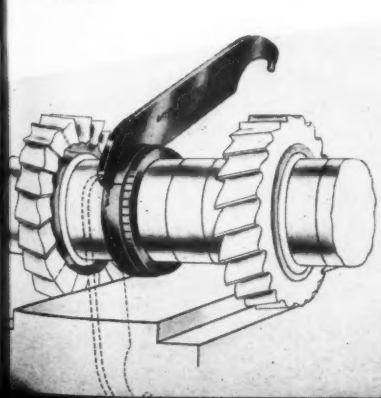
AN increased capacity Tap Reconditioner has been announced by Detroit Tap & Tool Co., 8432 Butler Ave., Detroit, Mich. The improved machine can handle all sizes and types of taps up to 1¼" diameter, including long shank tapper taps. The spiral pointing unit has also been improved to increase ease of handling.

BREMIL all alloy hand shear will operate continuously and safely without over-stressing any of its parts. Cuts without springing the jaw. Address Bremil Mfg. Co., Dept. TD, Erie, Pa., for descriptive literature.

A PORTABLE hydraulic bench for pre-flight checking of the hydraulic circuit of planes before leaving the ground is announced by Hydraulic Machy. Co., 10419 Grand River, Detroit, Mich. The testing includes putting the plane through all of its hydraulic functions without running the plane motors.

THE new double end pin spanner wrench (left, below) for milling machine cutter arbors, overcomes hand adjustment and simplifies desired adjustments between large diameter gang milling cutters. Dayton-Rogers Mfg. Co., Dept. O, Minneapolis, Minn., is the manufacturer.

THE Challenge cut-off machine is designed to handle any metal up to one inch round. It it equipped with an elastic cut-off wheel and an adjustable safety guard above the wheel to protect the operator's eyes. Address Challenge Machy. Co., Grand Haven, Mich., for details.



(Continued from Page 60)

Then, too, a broaching machine is a tremendously powerful "pulling (or pushing) mechanism," capable of exerting a pull or push up to 75,000 pounds —even more in the largest machine types when fully loaded. In the broaching operation this force is distributed over a number of cutting teeth, the number depending upon the length of the part to be broached. Each tooth is designed to assume its fair share of the load. An ample safety margin is allowed to handle such unexpected hazards as hard spots in the metal, deeper cuts than anticipated due to uneven wall sections, eccentricity in hole location, and inequalities in casting outline and form.

A broach is inherently a pulling tool (although certain types are designed for pushing) and is designed to be pulled straight through a hole. An abnormal side load, concentrated at a single point well away from its ends, may chip the teeth or actually cause breakage of the broach. Never expect a broach to correct excessive eccentricity due to inaccurate previous machining which affects the location of the part in the broaching machine. Since a broach, when correctly used, will produce a hole of maximum accuracy and straightness, broached holes are ideal for use in locating parts for machining. The soundest practice is to broach first and then machine the O. D., faces, etc., locating from the broached hole. This should apply equally to sequences of finishing as well as sequences of roughing operations.

FLATNESS and SMOOTHNESS
of Production Parts
The Ultra-Lap machine will finish your parts to a flatness of one light band or less . . . to a smoothness as low as one micro-inch R.M.S., any metal or material. Much faster, more uniform than hand method. Machine designed for you or we shall be pleased to lap your parts on a job basis. Ultra-Lap machines and service used by aircraft and many other war-time industries.
Ultra-Lap MACHINE COMPANY
245 McDOUGALL AVE. • DETROIT, MICH.

Proper Broach Handling

This important part of broach use includes not only correct handling and storing of broaches in the shop, but proper means of interdepartmental transportation to and from the sharpening equipment and the broaching machine. Shipment back to the broach maker for sharpening also involves handling. Broaches should always be shipped so that the teeth come into contact only with wood or some other soft substance. The teeth of a broach should never come in abrupt contact with any hard material such as a metal bench, edges or sides of a storage bin, or against another broach. Remember that the teeth are exceedingly hard and sharp—as many a shop man has discovered when he has inadvertently rubbed his finger or hand against them. Even the slightest nicking of a tooth reduces the effi-

ciency of the unit. It may require re-sharpening or reconditioning to place it in proper operation.

Design of Racks

The most satisfactory method of handling broaches in the shop is to provide racks designed to support each broach in a nearly vertical position. Contact of the broaches with the rack should be near the ends of each broach regardless of its length, and the contacting surfaces of the rack should be of wood or similar soft material. Avoid having the cutting teeth strike any hard material while the broaches are placed in or removed from the rack. Storage bins should also be lined with wood.

Where broaches must be transported to and from the shop and the tool room, the rack may be equipped with wheels or rollers so that it may be easily moved and brought close to the broaching machine.

Broach Sharpening

Not only will broach life be prolonged by correct sharpening, but satisfactory production —which means both quantity of parts produced and their conformance to specified dimensions and finish —may be impaired, unless this operation is performed properly.

The sharpening equipment should be designed specifically for this operation. The broach sharpening machine must be in good condition—free from undue wear, and be adjustable to correct angles in order to maintain the necessary tooth form for the entire length of the broach. In grinding, if there is any doubt about the correct tooth angle (rake) the engineering blueprint of the broach should be consulted.

A point to remember is that only enough metal should be ground from the face of a tooth to bring that particular tooth to the desired sharpness. Treat each as an individual grinding job and sharpen accordingly. (Only for special types of broaches where the step per tooth is graduated to close limits is it necessary to grind exactly the same amount of metal from the faces of all the teeth. For such broaches consult the engineering blueprint supplied by the broach manufacturer.)

It is also important that the correct type of grinding wheel be used. The wheel size, grain and grade all have a bearing upon the speed of sharpening, prevention of burning and glazing of the wheel, just as for other tool sharpening operations.

(Continued on Page 134)

The **NEW PORTMAN** *Rotary* **SURFACE GRINDER**

with advanced features assuring speed and accuracy

This new machine is of unit construction having a heavy box type base containing coolant system, a rugged motor head column, roller mounted column sub-base and fixed, magnetic rotary chuck drive incorporated in base of machine. Drive is by a totally enclosed 7½ H.P. motor mounted integral with precision spindle head. Motor head and column are adjustable for concave, convex and flat surface grinding.

Five speeds for all classes of work are provided by magnetic chuck drive. Machine has a capacity for handling work 14" diameter and 9" high. Simplified control assures easy handling and maximum production.

Investigate!

PORTMAN MACHINE TOOL CO.

17 Beechwood Avenue

MOUNT VERNON NEW YORK

(Continued from Page 133)

Machine Setup

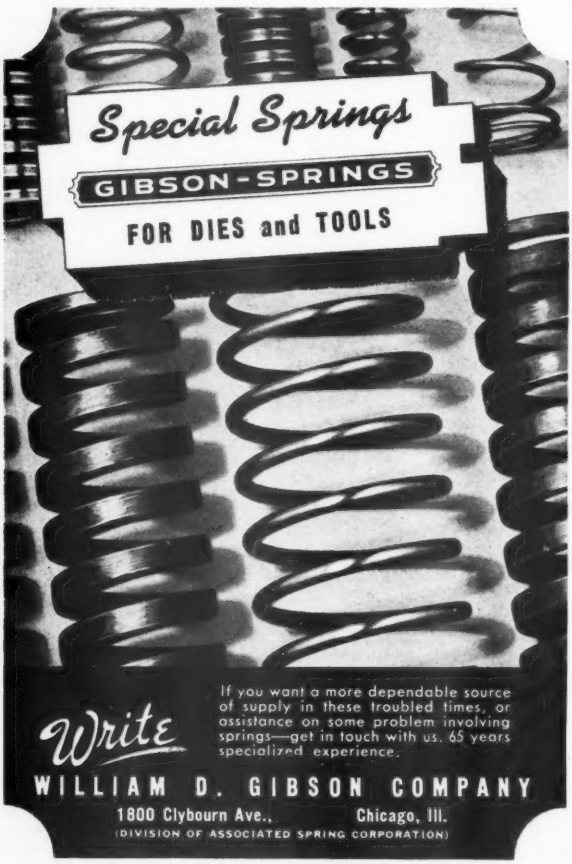
To assure proper machine setup, make sure that the broaching machine is of *adequate capacity,* including length of stroke. While the broaching speed is subject to considerable variation with satisfactory results, unnecessarily slow ram speeds reduce the productive rate and sometimes affect the finish of the part. The capacity must always be sufficient to prevent stalling of the broach in the work or jerky operation during the cutting stroke. Broaching machines should be kept up to rated capacity at all times.

The centerline of the ram head and puller must always be in *alignment* with the centerline of the work. Similarly the followrest, if used, should be in alignment with the centerline of the broach. Wear in the ways of the machine, in the puller mounting, in the followrest bars or in the broach mounting hole in the followrest should not be excessive if accuracy is to be maintained and possibility of broach breakage avoided. This applies to pull-up, pull-down and horizontal type broaching machines performing any kind of hole broaching, such as round, spline or keyway cutting operations.

In helical spline cutting operations where a broach drive head is required, the master lead bar, driving mechanism and puller adapter must be maintained in good condition if an accurate helix angle of the broached spline is to be obtained. This is doubly important if the spline in the part to be broached is of considerable length and the helix angle is large (short lead).

When holes, splines or keyways are to be broached, the centerline of the *fixture* in the face plate or platen of the machine must be accurately located. The work should fit the fixture as closely as possible and still permit ready insertion and removal of the part. Where a question of extreme concentricity is involved, it is usually far better from a production standpoint to broach first and then machine the OD in relation to the hole.

Several additional points are important in surface broaching. The fixture must be of rigid construction to prevent


Special Springs
GIBSON-SPRINGS
FOR DIES and TOOLS
Write
If you want a more dependable source of supply in these troubled times, or assistance on some problem involving springs—get in touch with us. 65 years specialized experience.
WILLIAM D. GIBSON COMPANY
1800 Clybourn Ave., Chicago, Ill.
(DIVISION OF ASSOCIATED SPRING CORPORATION)

any movement of the part during the pass. The method of holding the part in the fixture, and the pressure applied in holding it in place must be sufficient to prevent slippage during broaching as well as to hold the part in correct relationship to the broach cutting surfaces when inserted. This is highly important both to assure accuracy and prevent catching of the part against the broach during the pass. Just as many difficulties have been traceable to insufficient fixture rigidity in broaching as in other forms of machining operations.

The previous precautions about rigid construction of the fixture and holding the part rigidly apply especially to fixtures which also handle the indexing of parts between successive broach passes. The design of the fixture must guard against backlash, thus eliminating the possibility of the part rotating during the pass of the broach. This applies particularly to continuous high production surface broaching operations when extreme accuracy is required as in producing aircraft and similar precision parts.

Whenever a cored or forged hole is to be broached from the rough an equalizing fixture should be used. The use of a fixture of this type prevents highly localized tooth loads and any tendency to force the broach out of alignment. For the same reason a drilled hole should be square with the face or surface of the part against which it is located in the broaching fixture.

Machine Operation

The broach should never be returned to initial position until the work has been removed. Unless the piece is removed the end of the broach may strike the edge of the hole, not only causing possible broach breakage, but often damaging the fixture.

Before starting the broach pass make sure that the piece is firmly seated in the fixture. In round or spline broaching this means that the piece is as fully seated in the retaining adapter as possible, and that it is seated "all the way around" and is not "cocked." Similarly, in surface broaching, the piece must be properly seated and the retaining clamps brought up to full contact pressure, either by hydraulic or mechanical action, depending upon the type of fixture used. Should the part "jump" into full contact with the fixture, while the broach is moving, tooth breakage is almost certain to occur. In the case of a hole broach, the broach itself may be broken off in addition to tooth breakage.

Should the broach become stuck in the work due to inadequate machine capacity, excessive broach dullness or lack of

(Continued on Page 136)

Our Services

Flame Hardening · Annealing · Aerocasing · Bar Stock Treating and Straightening · Heat Treating · Pack or Gas Carburizing · Sand Blasting · Chapmanizing · Tempering · Cyaniding · Nitriding · Hi-Speed Hardening

METAL TREATING INSTITUTE

THE LAKESIDE STEEL IMPROVEMENT CO.

5418 Lakeside Avenue CLEVELAND, OHIO Phone Henderson 9100

(Continued from Page 135)

sufficient power, removal of the work from the broach becomes an operation requiring special care if damage to the broach is to be avoided.

Never attempt to reverse the broach out of the work while still in the broaching machine. Tooth breakage is almost certain to occur if this is done. The proper procedure is to utilize one of the methods given below, after first carefully removing both the work and the piece, without attempting to either separate or even loosen the part on the broach. Care must sometimes be exercised in removing the stuck work and broach from the fixture. Gradually ease the work from its position by tapping it lightly and at the same time manually supporting the ends of the broach.

Recommended methods of removal: (1) Lightly tap the piece and slide it off the small end of the broach. This operation requires care in assuring that only light blows are used and that the tapping is done successively on opposite sides of the part to avoid unequal loading of the teeth. The alignment of the piece on the broach must be carefully maintained until it is entirely clear of the teeth.

(2) If the piece cannot easily be removed in this manner, it is probable that a tooth is broken and has become jammed. In this case, place the broach and the stuck part in a lathe and turn off the piece. Adequate steadyrest support must be provided to prevent heavy side-loading of the broach or chattering of the cutting tool against the part during the turning operation. This method is recommended where the piece is externally round and has thick walls.

(3) The piece may be sawed in two and thus freed of the broach. Pieces of thin section are most quickly removed in this manner. Be sure that the piece is held securely when sawing and that the broach is also adequately supported, especially if the latter is relatively small in diameter. Modern hardened and ground broaches are so hard that there is little chance of their being damaged by a hack saw.

(4) Combination of methods 2 and 3 may also facilitate removal of the part.

(Continued on Page 148)

Don't be "stumped" if the specifications call for

DRILLING HARDENED STEEL

● You can do it! HARDSTEEL Drills enable you to drill, counterbore or enlarge holes in hardened steel by the same methods you would use on soft steel, and *without annealing any portion of the piece.* A remarkable time-saver! Write for illustrated instruction booklet.

We can fill your requirements for Die Springs, Dowel Pins and all other Die Maker's supplies.

DIE SUPPLY CO.

J. R. Fitzsimmons W. H. Fitzsimmons Jos. T. Fitzsimmons

4751 Hough Ave., CLEVELAND, O., EXpress 1133

(Continued from Page 58)

"RMS" specification only, without the other characteristics of the surface being specified.

Figure 14 shows a partially lapped surface on which most of the grinding finish still remains. It will be noted that while a considerable portion of the irregularities fall below the center line of the chart, there are still quite a few remaining above the center line. This surface gives an "RMS" reading of .39, the "RMS" reading being taken on the *same exact trace* as that taken by the chart.

Figure 15 shows a surface finish with the popular multi-motion lapping operation and on this *exact trace* the "RMS" value indicates .35. It will be noted that in Fig. 15 most of the irregularities fall below the center line of the chart, with quite a few scratches indicated by the letter "X" falling considerably below the center line. These scratches, however, are of sufficient value on the "RMS" meter indications to step up the average value almost equivalent to the average value shown in Fig. 14. If these deep scratches were eliminated, the "RMS" value of the chart shown in Fig. 15 would fall to approximately .17 "RMS". However, if a surface as shown in Fig. 15 were desired and if the "RMS" value only were specified, a surface as shown in Fig. 14 could be furnished by the supplier to meet the specifications, but which may not fulfill the purpose intended, or the desires of the designer.

Many engineers have a marked preference for nominally smooth surfaces to carry the bearing loads, but which are characterized by a few deep scratches to act as oil pockets. It is the claim of the Brush Development Co., therefore, that a chart which shows the characteristics of the individual irregularities is much more enlightening than a "RMS" value which indicates roughness only and not the direction of the roughness.

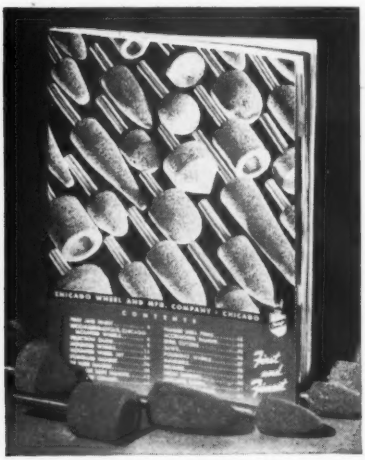
The original article in this series was opened with the statement that the entire subject of surface finish inspection and specification has, unfortunately, been beclouded with an air of mystery. An attempt has been made to indicate some of the individual characteristics of surface finish, which must be considered if the surface is to perform in accordance with the intentions of the designer.

-75°F
MEANS LONGER LIFE FOR PRECISION GAUGES
MEANS MORE ACCURATELY CALIBRATED AVIATION INSTRUMENTS
MEANS SUPER ALUMINUM SHEETS FOR PLANES
Revco
INDUSTRIAL
SUB-ZERO EQUIPMENT
Revco engineering insures quality sub-zero equipment for tool and instrument manufacturers. Also coolant coolers for metal cutting machines and special automatic rivet coolers for aircraft plants.
Write for further information.
REVCO, INC., Adrian, Michigan

SHOP AIDS

MOUNTED WHEEL MANUAL—a new manual published by the Chicago Wheel & Mfg. Co. features colored illustrations of the product. All types of mounted wheels and a wide variety of portable tool accessories are shown. The comprehensive booklet points out many time-saving ideas on the use of portable tools and mounted wheels. This should prove a valuable addition to every shop library.

One of the features that is particularly interesting is the selection guide for mounted wheels. A section is devoted to a newly developed polishing wheel which is proving a cure for many production ills. For your copy address Chicago Wheel & Mfg. Co., Dept. TD, 1101 W. Monroe St., Chicago, Ill.



BLUEPRINT READING FOR THE METAL TRADES—by W. A. De Vette and D. E. Kellogg, Vocational Department of the Erie Public Schools, was written primarily for the shop man who wishes to convey information to his co-workers by means of free-hand sketches or to clarify a drawing for himself. The authors, in this 130-page book, have included line drawings and actual blueprints to amply illustrate all points. Sketching and reading assignments plus sketching problems make this book of added value for those interested in improving their blueprint reading. Price, $2.50.

WELDING TRAINING—Two new training books, Dunwoody Arc Welding Job Training Unit and Dunwoody Gas Welding Job Training Unit, are now available. These books have been "tested on the job" in the actual training of thousands of students in the regular vocational and trade school programs, in the war training programs and in industrial training.

The Arc Welding Unit consists of 40 jobs with information and check-up questions. There are 103 pages, numerous illustrations and a page of fundamental welding symbols.

The Gas Welding Unit also consists of 40 jobs with information and check-up questions. Included in the 92 pages are many illustrations and a page of welding symbols. Price, $1.25 each.

INDUSTRIAL INSPECTION METHODS—This book covers the correct use and application of precision measuring instruments, along with problems relating to the precision inspection of ordnance materials.

The book is divided into five sections. Section 1 takes up the broad subject of dimensional controls. All types of gages are described, illustrated and their use explained. Section 2 deals with testing for physical properties. Hardness testing, destructive testing, X-ray inspection and magnaflux inspection are included. Section 3 covers surface inspection. Section 4 takes up the organization of an inspection department. Section 5 is the Appendix which includes many useful charts and tables. Written by Leno C. Michelon, War Training Div., Illinois Institute of Technology. Price, $3.00.

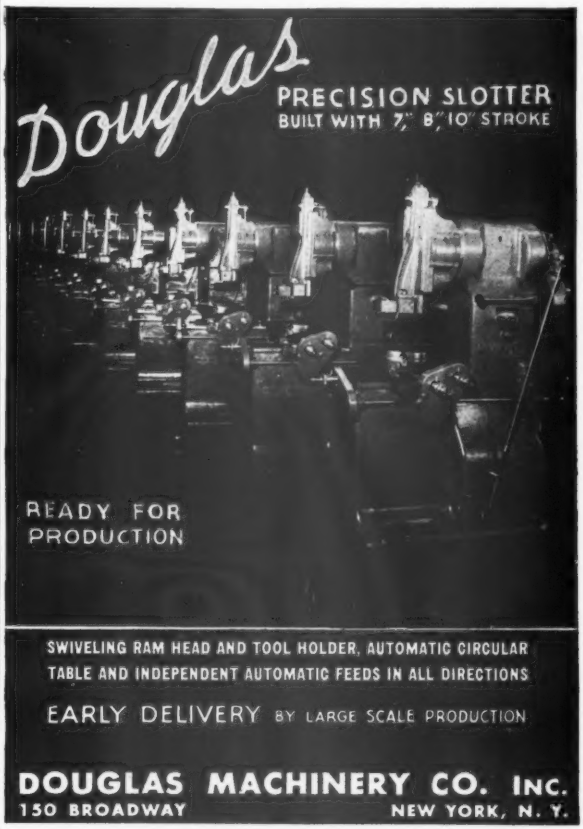
Coolant Pump Has Hydrostatic Balance

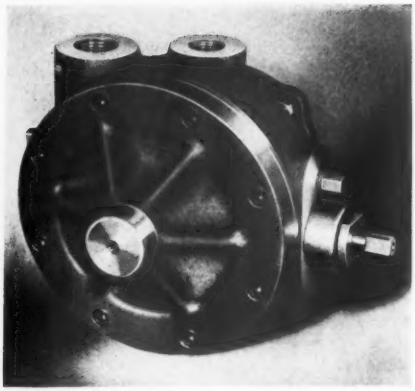
THE new model 5-P3 Gusher coolant pump keeps tool and work temperatures right for fast, efficient, trouble-free production. The discharge relation is available either right or left hand. The unit illustrated has the discharge opening to the right. The capacity of this pump, through ½" pipe at 5' head, is 10 gpm.

The impeller housing and mounting flange are cast in one piece. This mounting flange is larger so as to be interchangeable with larger size Gusher pumps. The purpose of this is to meet possible changes in working conditions or in types of machine production. This applies to installation on new machine tools as well as machine tools already in service.

The driving motor is a full ball bearing type with one-piece suspended shaft to the pump housing. Packing and metal contacts are eliminated. The seal, between motor and pump, is accomplished by the use of "lubri-sealed" ball bearings in direct conjunction with a centrifugal slinger. The impeller is the Ruthman patented twin equalized intake type which accomplishes hydrostatic balance. This feature also automatically cleans out the intake chambers when the discharge line is throttled. This acts as an automatic by-pass which prevents building up pressure.

Complete engineering and data sheets on this model will be furnished by The Ruthman Machinery Co., 1813 Reading Rd., Cincinnati, O.


Douglas
PRECISION SLOTTER
BUILT WITH 7," 8," 10" STROKE
READY FOR
PRODUCTION
SWIVELING RAM HEAD AND TOOL HOLDER, AUTOMATIC CIRCULAR
TABLE AND INDEPENDENT AUTOMATIC FEEDS IN ALL DIRECTIONS
EARLY DELIVERY BY LARGE SCALE PRODUCTION
DOUGLAS MACHINERY CO. INC.
150 BROADWAY
NEW YORK, N. Y.



Conical Cover Plate Increases Shock Resistance

HEAVIER section reinforcing webs, a conical instead of flat cover plate for increased resistance to shock and mounting bracket of a type that is considered "standard" by most manufacturers of hydraulic pumps feature the redesigned Hydra-Motive variable delivery pump.

This was originally designed and previously manufactured exclusively for use with the Duplimatic, an automatic precision-type machine tool control which requires high pressure delivery at extremely low volume.

The adoption of a mounting, which is considered standard by most pump manufacturers, permits the pump to be used as a replacement, or as original equipment, without changing current designs. Delivery is infinitely variable from 0 to 4 gpm and operating pressures are 1,000 psi with a top "short-interval maximum" of 3,500 psi. The unique method of balancing the individual vanes is an additional feature and is exclusive with the Hydra-Motive design. Being bevelled on two edges, as well as outer side, the result is a marked reduction in wear, elimination of over-heating and an increase in operating efficiency.

To permit maximum selection of adjustment, a split stator instead of the conventional solid ring is employed.

Hydra-Motive, Inc., 249 St. Aubin Ave., Detroit, Mich., will supply further information on request.

Cuts Cams with One Set-up

CASE HISTORY No. 7

The shaping of feed cams is a problem that is easily solved with a SLOTMASTER. The cam blank is chucked in a Dividing Head on a milling machine. The rise on the cam is then readily calculated between the Dividing Head Index and the Micrometer Dial on the milling machine Feed Screw. In this way a perfectly true and uniform cam rise is obtained. Only one set-up is required and the time for calculation is negligible. Any other method such as might be accomplished on a standard milling machine or shaper would require numerous time consuming set-ups.

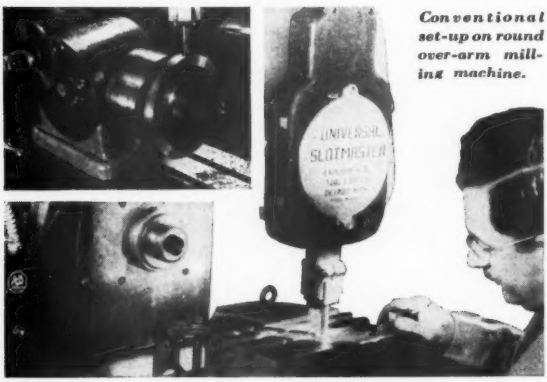
Thumbnail illustrates set-up.

SLOTMASTER can be used on milling machines and provides double duty facilities at a minimum cost. It requires but little time to change-over from one head to the other . . . The stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 s. p. m. . . . The tool holder, of the clapper box type, can be turned in any position . . . All of the working parts are of tool steel heat treated and ground to close tolerances . . . SLOTMASTER comes complete with pulleys, motor, belt and mounting adaptable to round over-arm or flat-on-round over-arm milling machines.

Send for 4-page catalog and give the specifications of the milling machines that you wish to equip. Immediate deliveries on high priorities.

EXPERIMENTAL TOOL & DIE CO.

12609 GREINER DETROIT, MICH.



Conventional set-up on round over-arm milling machine.

Graduated Swivel Head Featured in Index Mill

INDEX mills are definitely in the Victory program making parts for airplanes, tanks, guns, submarines, periscopes, binoculars, cameras and machine tools. In order to meet the rapidly changing tool and production requirements, Blank & Buxton has designed a simple and practical machine with low initial maintenance and operation cost.

Featured in the 40-H Index Mill is a swivel head with graduations 90° both ways, controlled by worm and worm gear swiveling device. A 3¼" quill travel to the spindle makes the machine useful for drilling and boring as well as milling on angles. Quill movement is controlled by a screw and nut which is superior to the conventional type of rack and pinion.

A drive was designed to produce speeds fast enough to use small end mills and at the same time speeds slow enough to do ordinary jig boring. Verniers 8" cross and 16" longitudinal, for precision locating and boring, makes it possible to produce smooth and perfect holes.

The spindle has No. 9 Brown & Sharpe taper; also six hard chrome plated splines driven by broached and hardened driver mounted on ball bearings at top of spindle housing so that no belt strain is transferred to the spindle.

The spindle runs in super precision preloaded ball bearings.

Blank & Buxton Machinery Co., 3110 E. Michigan Ave., Jackson, Mich., will send descriptive literature at your request.

New improved combination tool rest and wheel dresser. Tilting table for carbide tool grinding (optional). Circulating coolant system features sliding and tilting deflector.
Large sludge pan 24" wide x 35½" long, 8" deep has removable splash guard (shown in phantom) adds protection, aids cleaning.

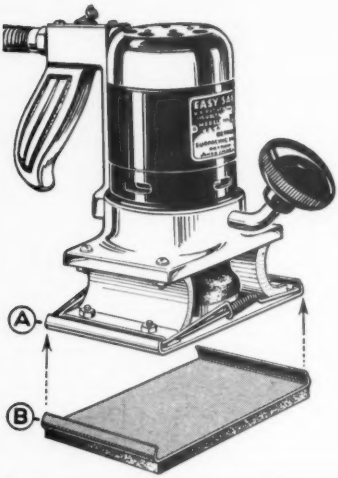
WRITE FOR BULLETIN 101

Hammond Machinery Builders INC.

★★★ 1631 DOUGLAS AVENUE ★★★

KALAMAZOO • MICHIGAN

Eastern Branch—71 West 23rd Street, New York, N.Y.



Quick Change-Over Possible With Detachable Bottom Plate

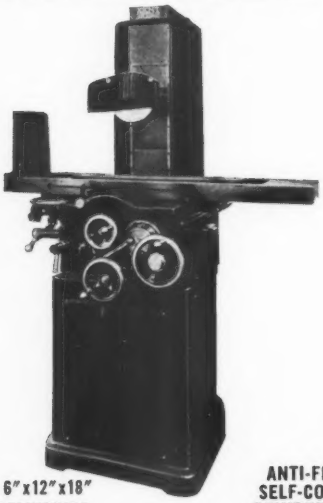
THE importance of finishing operations in war production cannot be too strongly emphasized. As a result, reciprocating type sanding machines are being used for hundreds of finishing applications on metal, plastics and composition. The reciprocating action of the Easy electric sanding machine duplicates the back-and-forth motion of hand work. Speed of operation is 3000 strokes per minute as compared to approximately 150 strokes per minute by hand.

A unique feature of this machine is a detachable bottom plate. The illustration, left, shows detachable bottom plate B with ¼" thick rubber sanding pad, which is attached to the machine A. This new type plate permits instant removal of one type or size pad and the installation of another. Detachable bottom plates are available with pads of sponge rubber, felt or composition. This feature makes for quick change-over from wet to dry work without waiting for the pad to dry.

Cleaning aluminum airplane skins or parts before welding, roughing laminated plastics sheets to provide bond for finish, finishing dies, aircraft or machine gun parts will require pads of the correct size and degree of flexibility to fit the specific job.

If you will state your finishing problem, the Detroit Surfacing Machine Co., 7430 W. Davison, Detroit, Mich., will be pleased to furnish application recommendations and the experience of other users on the same class of work.

ATLANTIC
No. 2 Automatic Precision
SURFACE GRINDER



CAPACITY 6"x12"x18"
PROMPT DELIVERIES

ANTI-FRICTION
SELF-CONTAINED
GRINDER SPINDLE

ATLANTIC MACHINERY CORP.
149 Broadway New York, N. Y.

New Tool for Accurately Centering Layouts Announced

AN entirely new type of locating and centering tool that is particularly effective in accurately centering layouts to spindle has just been announced by the Center Scope Instrument Co.

According to the manufacturer, this new Center Master reduces the number of steps necessary in locating and centering work to the spindle axis. It is said to increase accuracy because it compensates for spindle and adapter run-out and because it is easier for the operator to center his work lines between the scribed lines on the locating glass.

The Center Master is simple in construction and operation, yet extremely accurate and easy to use. Overall length is 3¼" with ⅜" spindle shank 1" long. It has a knurled trimming screw for compensating run-out.

It is claimed that there is no parallax and that every operator, even "green" trainees, can do better, more accurate work with this patented device. The Center Master is not a delicate instrument to be kept under lock and key, but rather one to be kept on the work bench ready for instant all 'round use.

Literature is available from the manufacturer. Address Center Master Div., Center Scope Instrument Co., 350 S. La Brea Ave., Los Angeles, Calif.

"Training for Victory" features proper grinding techniques. See pages 67-82.

Something NEW YOU should KNOW ABOUT

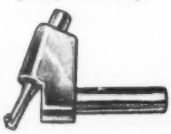
• EASY TO OPERATE • SPEEDS PRODUCTION
• EXTREMELY ACCURATE • LASTS A LIFETIME

MAKE-ALL RADIUS DRESSER

not just another new tool, but a proven accurate time-saver for your simplified Male and Female Radius Dressing operations. Feature of the Make-All is simplicity of design that results in an unusual degree of accuracy for a radius dresser requiring no difficult calculations, depth gauges, micrometer or vernier setting. Send priority rating with your order for prompt delivery.

ATTACHMENT FOR FULL SEMI-CIRCULAR RADII

A special attachment accurately made, which with the use of Rattail Diamond Tools, will make full semi-circular radii as small as 0.035". Available at small additional cost.



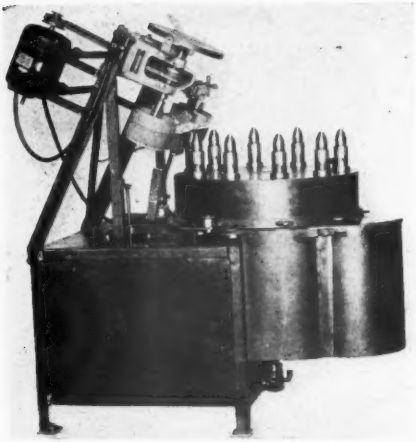
$62.50 MAKE-ALL with one 60° GOLCONE Diamond Tool.

$72.50 MAKE-ALL with 60° GOLCONE, semi-circular radii attachment and Rattail Tool for 0.070" or larger radius.

Distributed by

Golconda Diamond Products Corp.

3856-58 NORTH ASHLAND AVENUE • CHICAGO, ILL.



37 MM Shot Tips Polished Automatically

ILLUSTRATED is another very important addition to those machines and devices which are being presented with increasing frequency to add to our growing facilities to win the war.

Since 37 mm shot tips must be prepared for tinning, this machine is so arranged that a number of rotating chucks, mounted on a rotating wheel, hold the parts to be polished. The chucks are loaded at a point where they automatically stop rotating. The rotating wheel indexes intermittently, bringing the work against the running abrasive belt where it dwells for a short period while it becomes polished. The abrasive belt, which is driven by a separate motor, has a range of three speeds.

Two small motors individually drive the chucks and the wheel. The driving mechanism is enclosed in the dust tight base.

The abrasive belts are inexpensive and quickly replaced in a few seconds so that aside from the single operator required to attend the machine very little cost of operation is involved.

This machine occupies a floor space of about 38″ x 45″ and about 52″ high and comes complete as shown.

Leiman Bros., KA-141 Christie St., Newark, N. J., will send further details and descriptive literature at your request.

LINCO *Two Spindle*
ADJUSTABLE
DRILL HEADS
DRILLS TWO HOLES AT ONCE

✓ *Adjustable Centers from ½" to 6"*
✓ *Drill Capacity 0" to 5/8"*

Sleeve and overarm types . . . in several sizes. Will double output of any single spindle drill press.

Quickly adjusted to desired drill centers from ½" to 6".

Send for bulletin.

LINDERME MACHINE & TOOL CO., INC.
12250 COYLE AVE., DETROIT, MICH.

Operating Time Saved by Automatic Brake

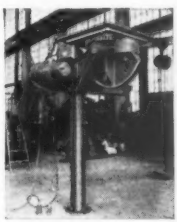
A NEW cam type turret lathe has been added to the extensive line of Foster turret lathes. The bed has internal cross ribs for rigidly supporting the carriages — permitting heavy, accurate cuts. Bed and headstock castings are scientifically ribbed throughout to insure freedom from vibration and extreme rigidity for accurate turning.

Eight spindle speeds are controlled by levers mounted on top of the headstock. One lever, controlling the double multiple disc clutch on the main drive shaft, may be used to shift the lathe into neutral. In addition, it controls forward and reverse spindle rotation. When this lever is placed in the central position, the machine is again in neutral and a powerful brake automatically stops the spindle. Valuable operating time is thus saved by eliminating a wait for the spindle to coast to a stop.

The universal carriage is provided with six reversible cross and longitudinal feeds which operate independent of the hexagon turret carriage. The hexagon turret ram slide carriage is provided with six power feeds to the ram slide in the forward direction.

The Foster universal ram type turret lathe is supplied complete with tools for both bar and chucking work.

Address Foster Div., International Machine Tool Corp., Dept. 20, Elkhart, Ind., for literature.



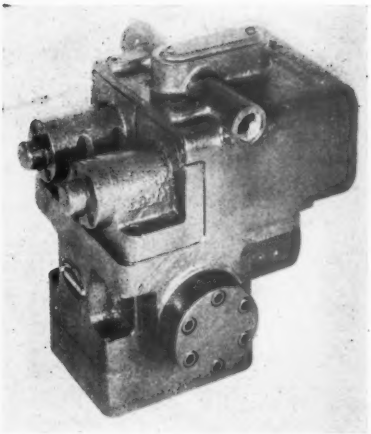
C-F POSITIONERS ***are universal tools . . . for handling and holding work***

Capable of tilting, turning and holding giant weldments and assemblies so that every weld can be made down hand, C-F Positioners also save time, labor and lower the cost of positioning and holding work for chipping, snagging, grinding, flame hardening and machining operations like angular drilling, etc. Today C-F Positioners are found not only in the welding shops but in machine shops, die shops and production lines as well. 6 sizes, capacities from 1200 lbs. (hand operated) to 30,000 lbs. Each a universal tool, pedestal mounted, adjustable for height, with table that turns completely around and tilts at any angle to 135° from horizontal.

WRITE FOR BULLETIN WP 22.

"Adjustable for Height" *C-78*

CULLEN-FRIESTEDT CO.,
1316 S. KILBOURN AVE. CHICAGO, ILLINOIS



4-Way Valve Elminates Separate Pressure System

AN improved four-way valve features either closed or open center operation by a slight mechanical adjustment. Used on a machine tool, a production oven, or wherever spring centered, four-way valve operation is desired, it permits a change to a different type of operation without replacing the valve. All that is necessary is the removal or installation of a ⅛" socket pipe plug.

The valve is available in three models of 10, 18 or 28 gpm capacity, with a maximum recommended working pressure of 2000 psi. The need for a separate pilot pressure system is eliminated because the valve contains integral dumping valve.

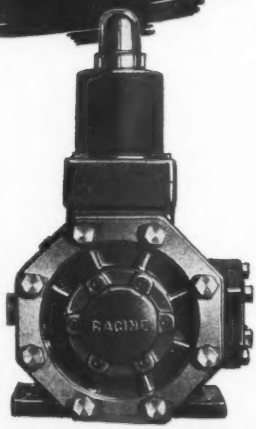
The main valve spool, which is normally spring centered, is operated hydraulically by pilot valves, which are normally spring offset. These, in turn, are activated by solenoids to produce a full range of four-way valve operation. In addition, when adjusted for closed center, de-energizing the solenoids blocks all ports; while, when adjusted for open center, de-energizing the solenoids blocks the cylinder ports but leaves pressure open to tank.

Principal uses of the valve include raising and loading broach carrier cylinders, raising and lowering doors and elevators in quenching operations and pushing stock through heat treating furnaces.

Further details are available from Hydraulic Hi-Speed Co., 5434 Tireman Ave., Detroit, Mich.

Reserve power built into your products gives them a competitive advantage in performance. RACINE Variable Volume Pumps have that extra reserve as they pump only the volume oil actually required by the circuit. In those operations requiring holding, pressing, clamping and forming, they maintain pressures from 50 to 1000 pounds without wasting horse power normally spent in bypassing oil and in oil heating as in constant volume systems. RACINE Variable Volume Pumps are made in three sizes to give the maximum volume desired from 0 to 12, 20 or 30 gallons per minute.

Write for complete details and specifications in our new catalog P-10-C. Our engineers will be glad to show you how our equipment can be readily designed into your products to give them added power reserve.



RACINE TOOL & MACHINE CO.
1768 STATE STREET · RACINE, WISCONSIN

2000° F Furnace Heat Maintained for Constant Operation

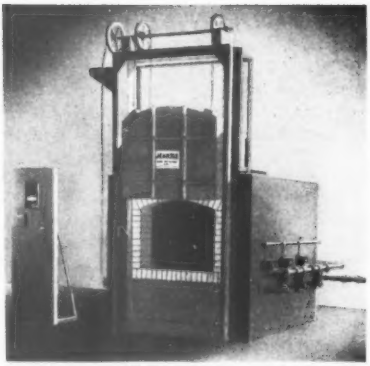
"FORTY-NINE Days from Idea to Plant Operation" is the speed record recently set by the Johnson Gas Appliance Co. in producing a large heat treating furnace for one of the nation's busiest war plants.

When Johnson engineers were confronted with this manufacturer's heat treating problem, they immediately set to work designing and building a furnace that would produce 2000° F and maintain this for constant operation. On the 49th day after the problem was submitted, the furnace started operation in the plant.

This specially built Johnson unit has inside combustion chamber measurements of 36" wide, 30" high and 60" long. The furnace is lined with 5½" insulation and faced with 4½" insulating refractory.

Among the unusual features of this furnace are the electrically operated door which raises in 5 seconds and stops automatically; proportioning-type control which automatically regulates furnace temperature and stack damper position; and push-button electric ignition that lights burners with complete safety.

Johnson Gas Appliance Co. engineers are constantly solving heat treating problems for large production plants and designing and building quickly the furnaces needed for specific jobs. All standard Johnson units can now be delivered in two weeks, if they carry A1-J priority rating or better.



Address Johnson Gas Appliance Co., 560 E Ave., N.W., Cedar Rapids, Iowa, for Catalog.

NO JOB TOO BIG for our research department

The "HARDSTEEL" drill is biting its way through a 17% manganese rail. Work hardening at its worst — all the way. Twelve feet long, weight 650 pounds. 55 1/4" holes drilled — 1-3/4" through — average time: two minutes each. Each hole finished to glass smooth wall. Good production life between grinds.

Every day our research department is drilling customers' samples to prove the claims we make for "HARDSTEEL" drills — their ability to drill oil-hardened, water-hardened, work hardening, cyanided and nitrided pieces, high carbon — high chrome, and high speed steels of any degree of hardness — without annealing.

"HARDSTEEL" is also available in reamers, tool bits and special tools.

HARDSTEEL DRILLS

You harden it — we'll drill it with "HARDSTEEL"

Write for literature

BLACK DRILL CO., 5005 EUCLID AVE., CLEVELAND, OHIO

REAMERS • TOOL BITS

(Continued from Page 55)

of by using a horizontally sliding wedge or key as seen at *N*. The key can be made an integral part of the fixture body by inserting two shouldered screws through it. The screws are tapped into the fixture body and are provided with clearance slots around them in the key.

In operation, the edges of the legs on the channel are placed down on surfaces *M* in the fixture. The key is then moved forward, which brings surfaces *L* into contact within the channel. The nuts over the clamps are then alternately tightened until the workpiece is rigidly clamped "home" and is ready for milling.

When using a key for locking the work in jigs and fixtures, its angle is usually made about 5°. If the angle is 7° or more, the key may become loosened by machine vibration and inaccurate cuts will result. The clamps are of machine steel and pack case hardened. Surfaces *L* and *M* should be lined with hardened steel and the key should also be hardened and ground for long wear. After making the milling cut in this fixture, width *O* on the work will be a constant dimension.

TRAINING FOR VICTORY

This 16-page section on Grinding Technique is the first of a series designed to help men in war production get the most from their tools. **Turn to page 67.**

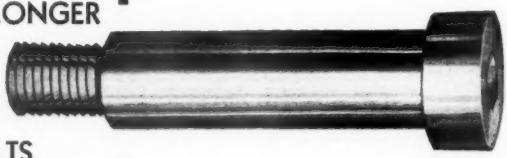
(Continued from Page 136)

Surface Broaching

In surface broaching if the broach stops before the stroke is completed and the stroke cannot be completed, a similar procedure is involved. Never back up the broach since this will impose a reverse load on the teeth.

The proper procedure is to loosen the piece in the fixture by unclamping the part. Then carefully retract the broach table, or otherwise carefully pull the part away from the broach. Only the lightest force should be exerted while retracting the table and releasing the piece.

DIES GIVE BETTER, LONGER SERVICE WITH *SAFETY SOCKET* HEAD STRIPPER BOLTS



- Methanol Method of Heat-Treating Insures a Clean, Uniform Bolt
- Special Attention Given to Close Tolerances. All Body Diameters Ground Accurately
- Under-cut to Allow for Tightening Flush to the Shoulder
- Concentricity Between Head and Body Guaranteed
- Fabricated from Special Alloy Steel
- Threads Die Cut, Held to High Limit, Class 3 Fit

MANUFACTURERS SUPPLY COMPANY
2640 CARNEGIE AVENUE
CLEVELAND, OHIO

CINCINNATI: WM. BUCHANAN SUPPLY CO., 339 E. 3rd ST.
YOUNGSTOWN: C. H. WILTSIE, 4177 OAK KNOLL DR.
ELLWOOD CITY, PA.: JOHN S. FISHER, 9 FIFTH AVE.
PITTSBURGH: L. A. REISMAN, 2035 FIFTH AVE.

Tap Sharpening and Reconditioning Machine Offers Longer Tap Life

THE Hybco tap grinder is a complete, universal tap sharpening and reconditioning machine. It is equipped with a chamfer sharpening head and a flute sharpening head.

The chamfer sharpening head is mounted directly on the left side of the base, providing rigid setup necessary for precision work. The base is calibrated to permit recording and duplicating of the best chamfer angles for individual jobs.

The tap is held by the shank in a precision collet and rotated by means of the hand wheel, sharpening all chamfers at each revolution. The Hybco tap sharpener offers longer tap life and control of close limit threads by enabling the operator to condition the tap for the material to be threaded.

The interchangeable Hybco flute grinding head is mounted on a vertical, lever operated slide. Taps are held by the shank with the same precision collets used in the chamfer sharpening heads, permitting the reclaiming of taps after the centers have been destroyed. The head is mounted vertically to sharpen or recondition flutes and swung at any angle to grind spiral points. The slide is graduated in degrees to insure the proper angle and to facilitate duplicating the most effective grinding of spindle points.

Henry P. Boggis & Co., 1277 W. Third St., Cleveland, O., has available a new circular.

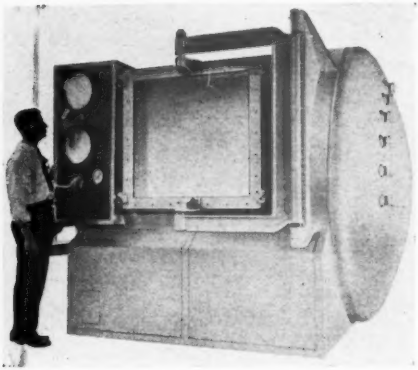
Starrett Precision Measuring Tools are potent weapons in the hands of America's army of skilled plane production craftsmen. They contribute to the winning of the war in the same way as do the precision products they help to make—by justifying the confidence of their users—permitting them to make the most of their skill and experience and will to win.

We shall continue to exert every ounce of effort to produce an adequate supply of the tools worthy of this responsibility.

THE L. S. STARRETT CO., Athol, Massachusetts, U.S.A.
World's Greatest Toolmakers

STARRETT
PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Stratospheric Chamber for Plane Testing



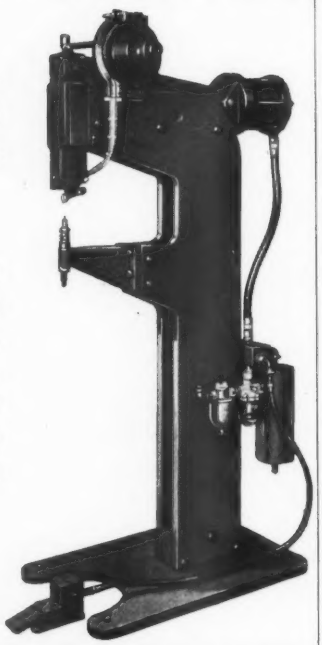
TO test the mechanical parts of aircraft and radio used in high altitude work, the Kold-Hold Mfg. Co. has developed and built a Stratosphere Chamber that operates between the temperatures of plus 200° F and minus 75° F, with an internal pressure variation from ambient at the location of the unit to 3" of mercury absolute. Both the pressure and temperature variations are controllable throughout their ranges.

This Stratosphere unit, which has an interior chamber volume of approximately 186 cubic feet, uses "Freon-12" as a refrigerant. The refrigeration effect, or heat acceptance from the chamber, is by forced convection through coils designed for low temperature work. Each coil will accept a minimum of 200 BTU per degree at minus 75° and 3" mercury pressure. Humidity control is from 25% to 95%, relative to all temperatures above plus 40° F or at a fixed bottom temperature of plus 32° F. Three indicating recorders are provided for continuous recording of temperature, pressure and humidity.

Trial tests were made during a recent special showing of the Chamber. On one such typical test, made by competent test and research engineers of a large manufacturing company producing aircraft, both output and input of their own product were determined accurately under stratospheric conditions. In only 4 hours time results were obtained that would have *(Cont'd on Page 151)*

Air Powered **RIVITOR**

Air Squeeze action plus automatic feed riveting for aircraft production.



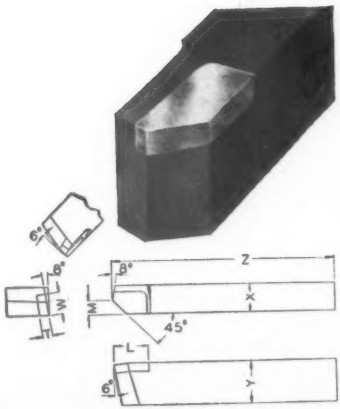
It's fast — 1600 riveted joints per hour with no manual rivet handling. This is an average figure. Increased or lowered production depends on the ease with which the work can be handled.

Write for Bulletin RP-1

this is a **TOMKINS-JOHNSON** *product*

630 North Mechanic Street **Jackson, Michigan**

New Carbide Tools Aid Shell Manufacturing



IN answer to the demand for a steel cutting carbide tool having a lead angle, McKenna Metals Co. announced two additions to their line. These tools combine the lead angle or side cutting edge angle with a tip longer than customary on carbide tools. Style 39, illustrated, and the opposite hand Style 40 (not pictured) will be considered as standard tools in the Kennametal line.

These tools are particularly economical in shell turning operations because only the edge on the lead angle is sharpened and it is easy to maintain the control position of the nose as the tool is reground.

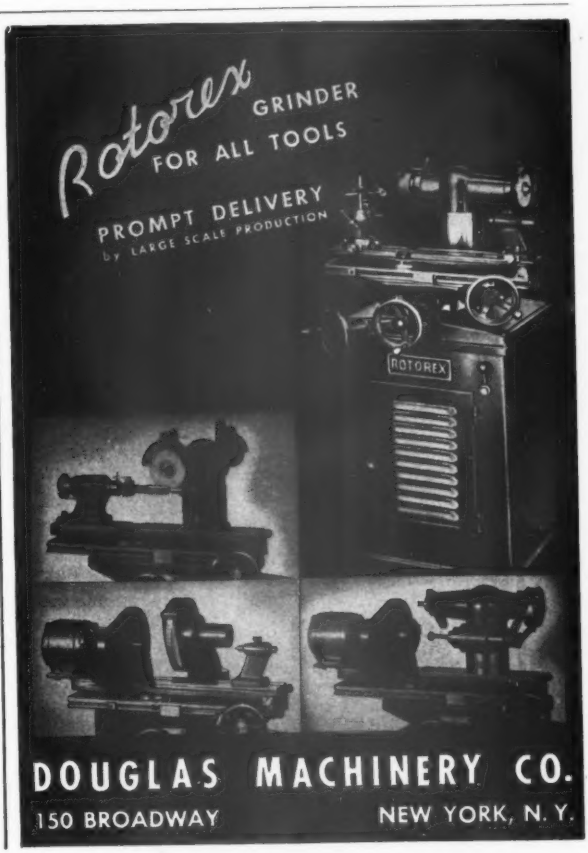
These tools are being widely used in shell turning where uniform forgings permit the depth of cut never to exceed the length of the tip having a lead angle. The chip breaker is ground only on the section parallel to this lead angle. These tools, which are available in sizes of ⅛" x $\frac{5}{16}$" x ⅝" to ⅜" x ¾" x 1½", may also be used for chamfering operations.

Complete information will be furnished by McKenna Metals Co., 600 Lloyd Ave., Latrobe, Pa.

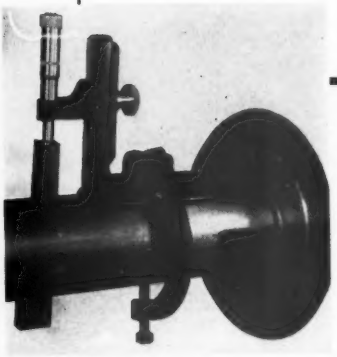
---

taken days to accomplish under former methods of utilizing a special plane and highly specialized test pilots —not to mention the time lost in waiting for ideal weather conditions.

Further details on the Stratosphere Chamber may be obtained from Kold-Hold Mfg. Co., 445 N. Grand Ave., Lansing, Mich.



TOOL SETTING GAUGE SAVES TIME — LABOR



Today time is too vital—labor too essential —to risk the waste of both because of inaccuracies in setting boring tools. Here the Bartelt Tool Setting Gauge enables *inexperienced* men and women to accurately and speedily set cutting tools in boring bars.

Production is speeded, costly errors are eliminated, and the facilities of the inexperienced are utilized advantageously.

This Gauge may also be used for milling machine setups, planer setups, as a height gauge, as a depth gauge, and for layout and inspection.

Send for illustrated literature

BARTELT ENGINEERING COMPANY

1216 Partridge Avenue — Beloit, Wisconsin

Valuable Booklet

Forgings For All Industries
Rough Turned or Finished Complete

•

Composite Die Sections — **Extrusion Tools**
Crankshaft Forgings — **Gear Forgings**
Die Casting Dies

•

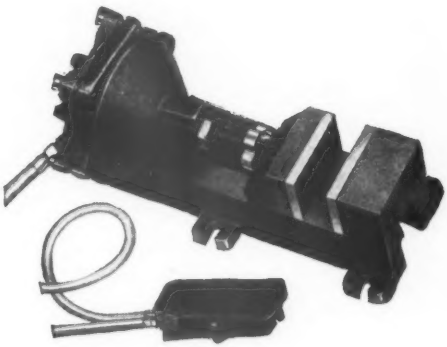
Rings, Discs, Blocks, Shafts, Hubs, Bars, and Special Shapes. Tool Steel of all Makes
S.A.E. Specifications
STAINLESS & COPPER FORGINGS
May We Serve You?

AJAX STEEL AND FORGE Co.

205 ADAIR STREET — DETROIT, MICHIGAN

Air Vise Speeds Drilling and Tapping Operations

PLANNED to speed up production on drilling, tapping, light milling, punching, bending, staking, straightening, stamping and riveting, this powerful foot-controlled pneumatic air vise hits a new high in operating efficiency. As many as 1200 operations per hour have been maintained with this vise.

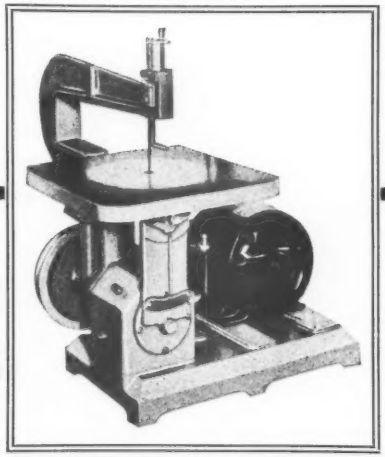


Operated by compressed air, the new Speedy Air Vise leaves both hands free for fast insertion and removal of work. The ram is driven by a long-life multiple type diaphragm instead of a piston. The movable jaw has a maximum travel of ½", gripping with an extreme force of 15 times air line pressure. A handy adjustment screw enables the operator to set the movable jaw anywhere up to its maximum opening of 3".

This air vise can be attached to an air line or to an individual compressor. It can be used on pressures up to 150 psi.

The Speedy Air Vise comes complete with air hose, foot controls and fittings ready for immediate use. Soft-steel jaw faces are easily fitted with cavities to hold castings, screw machine parts, etc.

W. R. Brown Corp., 5720 Armitage Ave., Chicago, Ill., will send Circular H-11 at your request.



Price, complete with motor— **$125** Net

F.O.B. Chicago

IMMEDIATE DELIVERY—Atlas Die Filing Machines

Can be used for all kinds of die making. The overarm is constructed so that the file and saw attachments may be interchanged with little effort. The holddown fingers are attached directly to the overarm. Working surface of the table, which tilts two directions, is entirely clear. An improved type of chuck, consisting of movable hardened jaws, holds both saws and files. Screw adjustment makes changes easy and fast.

ATLAS EQUIPMENT CO.

101 S. Clinton St. Chicago, Ill.

Detroit Distributor—International Machinery Co.
3131 E. Jefferson Ave. Detroit, Mich.

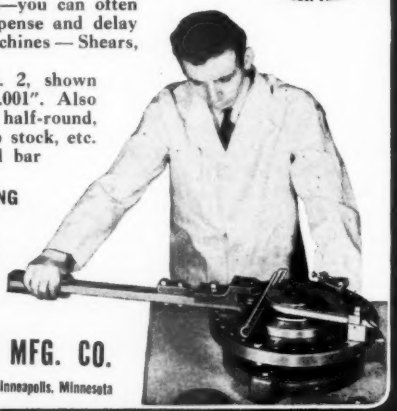
FORMING *without* DIES!

For 5 pieces, 500 or 5,000!

DI-ACRO PRECISION MACHINES

If you need any quantity from just a few duplicated parts up to sizable production runs—you can often make them faster and avoid die expense and delay by using DI-ACRO Precision machines — Shears, Brakes, Benders.

Illustrated: DI-ACRO Bender No. 2, shown forming ¾" O. D. tube, accurate to .001". Also bends angle, channel, rod; round, half-round, square and flat wire; moulding, strip stock, etc. Capacity, ½" cold rolled solid steel bar or equivalent.



Send for Catalog—"METAL DUPLICATING WITHOUT DIES" giving full information on the capacity of DI-ACRO Shears, Brakes, and Benders and illustrating their great variety of applications.

O'NEIL-IRWIN MFG. CO.

315 8th Avenue South, Minneapolis, Minnesota

MAJESTIC INTERNAL GRINDING MACHINE

The Majestic Internal Grinder meets the exacting requirements for internal grinding operations in the tool room and die shop. It offers reliable, balanced operation, maximum output and valuable help for all-out production.

Sturdy and durable, the Majestic Internal Grinder is equipped with Parker spindle and motor. Parker ball bearings and standard rotor and stator assure perfect balance for smooth spindle movement.

An adjustable work head has a graduated base which swivels 90 degrees on each side of the center for taper grinding.

Send for valuable circular.

MAJESTIC TOOL AND MANUFACTURING CO.

2946 Woodbridge Street, East :-: :-: Detroit, Michigan

New Electric Etcher for Permanent Marking

IDEAL Commutator Dresser Co. announces a new electric etcher that permanently marks sizes, names, numbers and other important information on tools, dies, gages, reamers, jigs, fixtures, punches, forming tools—anything made of iron, steel and their alloys. Permanent marking of materials and parts avoids confusion and mistakes; eliminates the cost and delay in obtaining precious metal nameplates and tags and thus saves critical materials.

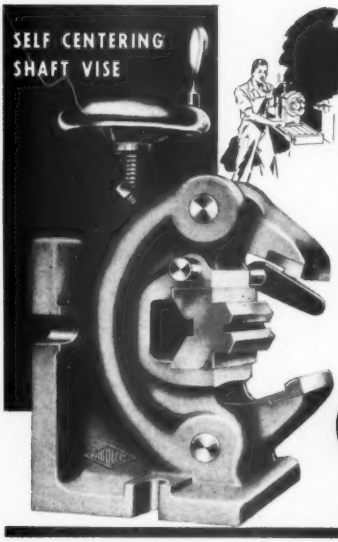
To etch small tools and parts, simply place them on the work plate, turn switch "on" to proper heat and start writing. A ground clamp conveniently attached to the work plate is provided for etching large, heavy parts and castings.

"Hi-Lo" taps and a seven point switch give 14 etching heats between 115 to 1300 watts. A red lamp on front of the etcher indicates when power is "on" and burns brighter as each higher heat is used. Depth of mark can also be controlled by speed of writing.

The complete etcher includes: heavy duty transformer; 5 oz. special heat resisting tool or hand piece with heat radiating fins; alloy tip etching point; heavy asbestos secondary cables; and 4" x 7" work plate with ground clamp attachment.

Ideal Commutator Dresser Co., 5186 Park Ave., Sycamore, Ill., will send complete details on request.

BLADES FOR CENTERLESS GRINDERS
... TIPPED WITH TUNGSTEN CARBIDE
Assure Greater Production and Accuracy in the finish grinding of bullet cores, armor-piercing shot, shells, projectiles, tank parts, aircraft engine parts, rifle and machine gun parts.
TALIDE
METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO



a Natural...
IN ANY SHOP

This modern machine vise is a "natural" because it just naturally is an asset to any machine shop. For machining slots and keyways in shafts or spindles, ⅜" to 3⅛" diameter — suitable for horizontal or vertical mounting. Setting of vise remains unaltered for all work diameters — insures accurate radial cuts. Hardened V jaw reversible in vise — equal movement of two jaws locates shafts correctly in V jaw.

Base size 8" x 7¼". Approx. wt. 80 lbs.

Write for circular.

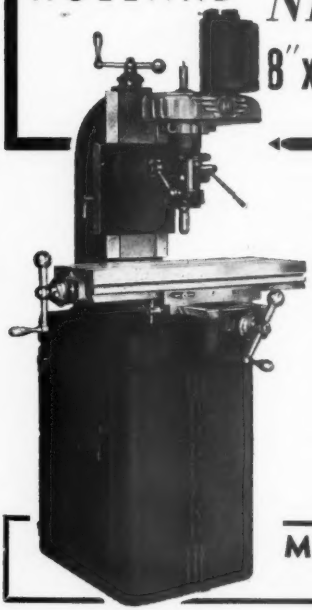
PRODUCTO

The PRODUCTO MACHINE COMPANY

990 HOUSATONIC AVE., BRIDGEPORT, CONN.
3017 MEDBURY DETROIT, MICHIGAN

HOLLAND

NEW 12 SPEED DRIVE
8"x16" VERTICAL MILLER
Speeds 200 to 4375 R. P. M



Widely used in aircraft plants as well as toolrooms, this miller has been improved with the addition of a new 12 speed drive. Featured by its high-speed head, convenient controls and wide speed range, the Holland Miller is easy to operate and efficient in sensitive drilling, high-speed end-milling, slow-speed boring operations, and in the production of small parts.

Write TODAY for complete specifications and details.

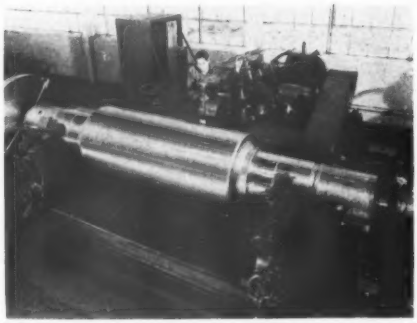
For Aircraft Parts Production

The holes on this aluminum link were spotted, bored and the entire radius and shank milled in one setting on the Holland.

MARBURG BROTHERS, INC.
88-92 West St., New York, N. Y.

Landis Grinder Designed for Hot and Cold, Sheet and Plate Rolls

LANDIS Type 30 Roll Grinders were designed for grinding of the larger hot and cold, sheet and plate rolls with either straight, concaved or crowned bodies. Roll necks may also be ground.



The massive live spindle of the headstock runs in babbitt lined steel, flood lubricated bearings. Flood lubrication of the work spindle, plus the use of babbitt lined steel bearings, assures long, trouble-free operation. With the drive located on a base completely separated from the bed, the headstock cannot pick up vibration from the drive, thus adding measurably to its smoothness of operation.

The grinding wheel head is carried by a V and a flat guide set well apart. It is impossible for the wheel spindle to be rotated without bearing lubrication, as the spindle drive motor will not start until the pump drive motor has raised pressure in the oil line to a predetermined amount. The size of the spindle prevents any appreciable deflection taking place regardless of the amount of stock removal. Another advantage arising from the design of the Landis grinding wheel head is the fact that breakdowns due to improper lubrication are practically impossible.

Landis Tool Co., Waynesboro, Pa., has profusely illustrated Bulletin L-11 available.

YOU CAN DO IT
Faster
..with IDEAL
Production Speeders
ELECTRIC MARKER
GRINDING WHEEL DRESSER
LIVE CENTER
BALANCING WAYS
DEMAGNETIZER
IDEAL
LIVE CENTERS
Turn Heavier Loads Faster
They rotate WITH the work—and thus permit heavier loads—faster speeds—deeper cuts! Radial load carried by high precision ball bearing, and thrust load absorbed by a taper roller bearing.
TRIPLE DUTY 3 interchangeable center pieces for all centered and uncentered work. Save set-up time.
FREE Catalog of these and other Production Speeders
IDEAL COMMUTATOR DRESSER COMPANY
4153 Park Avenue
Sycamore, Illinois
SALES OFFICES IN ALL PRINCIPAL CITIES
In Canada: Irving Smith, Ltd., Montreal, Quebec

PUBLICATION PREVIEWS

Sales and Technical Literature

Send Request on Company Letterhead

BARTELT TOOL SETTING GAUGE—for speedy, accurate setting of boring tools—saves labor and machining time, eliminates oversize holes and trial boring. Bartelt Engineering Co., 1216 Partridge Ave., Beloit, Wis., will send new circular illustrating typical boring bar applications and listing the many uses for the Bartelt Tool Setting Gauge.

"PRODUCTION DRILLS AND DRILL TABLES"—the Kelly-Springfield I-Beam Production Drill and Drill Table were primarily developed to drill heavy armor plate. Their range is so flexible that they lend themselves to almost every drilling and tapping operation. The O. S. Kelly Co., Dept. JK, Springfield, O., will send descriptive literature at your request.

SPEEDY AIR VISE—is a fast acting, hard gripping pneumatic vise effectively used on jobs such as drilling, tapping, light milling, punching, stamping, bending and riveting. It may be attached to an air line or to an individual compressor and can be used on pressures up to 150 psi. W. R. Brown Corp., 5720 Armitage Ave., Chicago, Ill., will send circular V giving complete details.

LACEY DIE SET MACHINE—is a "one man" press. It operates with one hand and under full manual and visual control. This machine is portable, easy to operate and makes it possible for the die maker to complete a die set by himself at his own bench. Marburg Bros., Inc., 88-92 West St., New York, N. Y., will send illustrated folder.

KEMPSMITH MILLING MACHINES—Kempsmith Machine Co., Milwaukee, Wis., has issued attractive Bulletin 102T which describes and illustrates their type G millers, designed particularly for tool room and light production work. To assure smooth, chatterless cutting, Kempsmith perfected a sliding gear speed and feed transmission that is simple, rugged, friction free. Other important features and a table of specifications are included in Bulletin 102T. Send for your copy.

LEACH EXTERNAL GRINDER—is designed for small parts up to 7" in diameter, 11" in length. Some of its important features include: six table speeds; micrometer adjusted tail stock with spring action; 452 square inches of hand scraped bearing surfaces; hardened and ground tail stock and dead center spindles. Complete specifications may be obtained by writing H. Leach Machinery Co., 385 Charles St., Providence, R. I.

LAFAYETTE FRICTION TAPPER—Developed for the unskilled operator, this tapper can be used in the drill chuck of any ordinary drill press. It works on a sliding axle. Forward pressure brings tapper into operation; the backward pull causes the tapper to reverse itself while the drill press is still running. Other outstanding features of the Lafayette tapper are listed in illustrated circular FT. Address Lafayette Tool & Supply Co., 176 Lafayette St., New York, N. Y.

COOLEY ELECTRIC FURNACES—profusely illustrated and described in Bulletin 50—were designed for industrial and laboratory uses. Shops that now depend on commercial heat treaters can do their own heat treating of small machine parts and avoid delays with Cooley furnaces. A list of uses, installation and operation data and complete specifications are included. Cooley Electric Mfg. Co., 215 S. Senate Ave., Indianapolis, Ind., will send a copy of the bulletin at your request.

FLEXIBLE SHAFT GRINDER KIT—This "first aid" grinding kit for tool rooms and die shops is tops for any light metal-finishing job particularly those requiring precise, accurate control. Model 111 kit, described and pictured in Form No. 63, contains a versatile assortment of mounted abrasive points, conveniently stored in a strong carrying case. Model 111 flexible shaft grinder comes with universal motor and Foredom's pencil size hand piece. Foredom Electric Co., 27 Park Place, New York, N. Y., will send Form 63.

Speed - Smoothness - Accuracy
WITH THE
LEACH INTERNAL GRINDER

On small parts up to 7" in diameter, 11" in length.

Massive base and pedestal. Extra bearing area. 452 square inches of hand scraped bearing surfaces. Power feed—six table speeds—micrometer adjusted tail stock with spring action. Work spindle mounted on two precision roller bearings. Wheel head spindle mounted on three precision ball bearings. Hardened and ground tail stock and dead center spindles.

SPECIFICATIONS

Table Feeds—⅜", 1 1/10", 1⅛", 1½", 2½", 3⅜" per minute.
Work Spindle Speeds—73-104-144-213-294 revolutions per minute.
Wheel Spindle Speed—2750 rpm. Spring Action Tail Stock.
Capacity ⅛" to 7" diameter, ¾" to 11" length.
Wheel—10" x ¾" x 2". Tank Capacity—3½ gallons.
Spindle Motor—¼ hp, AC, 60 Cycle, 110/220 Volt. Wheel Head Motor—1 hp, AC, 60 Cycle, 110/220 Volt. Regular equipment includes emery wheel, diamond wheel dresser, belts and wrenches.

EXCLUSIVE SELLING AGENTS

A LEACH DISTRIBUTOR IN ALL PRINCIPAL CITIES

H. LEACH MACHINERY CO.
385 Charles St., Providence, R. I.

for EXTREME ACCURACY in MEASUREMENT . . .

Acme GLASS OPTICAL FLATS !

Measure in Terms of Millionths of an Inch! A Test for Flatness, or an Accurate Comparator.

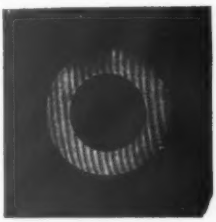
★ Acme optical flats and Monochromatic light furnish (in connection with your gage blocks) the lowest cost equipment capable of measurement in terms of millionths of an inch.

Measure in Terms of Microinches by Light Waves

In spite of the extreme accuracy possible with light wave measurement, the procedure is very simple. Place an Acme Glass Optical Flat on your work and gage as shown in the above illustration. The exact size of the work is readily determined from the number of bands that appear.

See illustration at right. The straightness of the bands formed by interference of light waves reflected from the flatlapped steel surface gives a true measure of its flatness.

For the best of all checks of accurately finished flat surfaces . . . to detect wear on your precision blocks . . . equip with Acme Optical Flats and Monochromatic Lamp. They allow rapid inspection of production items and assure peace of mind by furnishing a method to quickly and accurately compare your working set of gage blocks with your laboratory set.



For contract Flat Lapping send description of your requirements. No Obligation!

ACME INDUSTRIAL COMPANY
Makers of Hardened and Ground Precision Parts
206 N. Laflin St. Chicago, Ill. MONroe 4122

DIE DESIGNING AND ESTIMATING

CONTENTS

New Chapters Added, including:
Progressive Dies
Compound Dies
Drawing Dies

(Deep drawing section on cartridge case design, mathematical and graphical methods of determining diameters, shell wall thicknesses, punch and die sizes)

Outline of Equipment and Operations for Manufacture of Small Arms Cartridge Cases

15 New Estimating Tables

Separate Index of Time Value Tables

150 Practical Points on Die Designing and Building

"WILL be extremely helpful to us....", "very practical", "even better than I had hoped it would be"—these are comments by men in the precision tooling industry who have examined the new second edition of "Die Designing and Estimating". Orders for 50 copies (most on a second order after the book was reviewed) from a public library, 28 copies from an airplane manufacturer, 24 from an apprentice training instructor testify to the usefulness of this book. Largely written on request by specialists, the book covers its subject concisely, systematically and with authority.

The 160 pages have over 125 drawings, charts and photographs carefully selected to illustrate modern die designing practice. The estimating data (largely that of George Dannes) is complete enough to follow from rough sketch to a final, sound estimate.

Send for your copy today. Price $3.00 per copy plus postage. Write for quantity discounts.

AMERICAN INDUSTRIAL PUBLISHERS

338 Fairmount-Cedar Bldg. - Cleveland, Ohio

PORTABLE ELECTRIC HONING and FILING TOOL

(RECIPROCATING ACTION)

ELIMINATES HAND OPERATIONS!

MODEL C—3/8" STROKE
MODEL E—1/8" STROKE

Conserves time and energy by mechanically reproducing the natural push and pull action of hand operations . . . filing, honing, polishing, sanding, sawing, etc. . . . when equipped with the proper accessories. Will prove a boon to every Tool, Die, Mold, and Machine Shop.

Prompt delivery from stock!

Just off the press—Precision Production Tool Catalog No. 42

ACME TOOL COMPANY 200 CHURCH STREET NEW YORK, N. Y.

WHEN YOU MOTORIZE

MOTORIZE RIGHT

You must have each machine tool produce its maximum volume today. But it can't unless you get rid of power-wasting, production-slowing, hazardous and shop-cluttering overhead countershaft drives. When you put close-connecting power drives on your machine tools, be sure you not merely get more production but ALL the production such hook-ups can produce.

That means a Berkeley Drive every time. All machine tools are engineered to get specific results—and Berkeley Drives are individually engineered to make sure that those results are fully obtained! Simpler, stronger, safer, easier to install and operate, built for today's high speeds and heavier cuts, Berkeley Drives give vital plus values you should know about before motorizing any machine tool. Consult with Berkeley—first!

BERKELEY EQUIPMENT COMPANY • 1026 Bahls St. Danville, Ill.

Berkeley
Power Drives
V-BELT • HELICAL GEAR TRANSMISSION • P. O. S.

THE DRIVE FOR PRODUCTION

Write for Data Bulletin.

For Lathes • Shapers • Planers • Milling Machines • Punch or Drill Presses • Grinders of All Types • Any Machine Tool

★ **ELECTRO-MATIC RECTIFIERS**

specifically designed for industrial use—

PRECISELY engineered to meet increased demand for dependable rectifiers . . . In a range of 42 models — from 125 to 3000 watts capacity.

SIMPLE in operation. COMPACT — can be built directly into your equipment. Many other features.

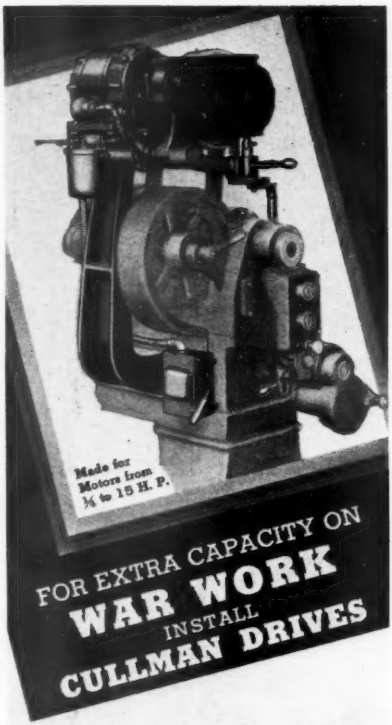
With the NEW AUTOMATIC TIME DELAY SWITCH (in larger units) to protect rectifier tubes. A "money saver and production increaser —" prevents throwing the load on tubes until properly warmed up, etc.

NEW BULLETIN "61" gives complete information. WRITE for your copy.

ELECTRO-MATIC PRODUCTS CO.

Makers: NEUTROL Electric-magnetic Chuck Control

2235-37 North Knox Ave. Chicago, Illinois



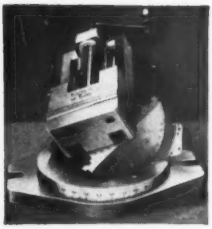
Lathes, milling machines, screw machines, shapers, punch presses, and similar equipment driven by overhead belting can be made 25% more productive by equipping with CULLMAN DRIVES at comparatively low cost. Old type machine tools will approach the output of the newest equipment because of greater flexibility, more convenient operation, and added safety.

CULLMAN DRIVES afford belt drive smoothness. They are rigid in construction and simple in operation. They reduce necessary floor space, and permit better lighting and shop arrangement. Installation is simple and can be made quickly—usually requiring only four bolts.

CULLMAN DRIVES are sold under a 60 day trial plan. Write for the facts.

CULLMAN WHEEL CO.

1332 Altgeld Street., Chicago, Ill.



Universal Vise

Universal Angle Plate

The WESSON
UNIVERSAL VISE
The Quick, Easy Way to Set-Up Compound Angles

Cuts set-up time; insures greater accuracy. Accurately graduated in all planes. Sturdy cradle design and steel construction give greater rigidity; permit faster stock removal. Two sizes, priced for every shop. Can be furnished with slotted surface plate for use as universal angle plate. AVAILABLE FOR IMMEDIATE DELIVERY. SEND FOR FREE FOLDER.

WESSON CO., Ferndale, Mich.

Please send me illustrated Folder covering the Wesson Universal Vise.

Name .....

Firm .....

Address .....

City ..... State .....

PUBLICATION PREVIEWS

(Continued from Page 158)

MOREY VERTICAL SHAPERS—Circular No. 725 describes the Morey 8", 12" and 16" vertical shapers. Detailed photographs and blueprint diagrams illustrate the important features. A table of specifications is included. A copy of attractive circular No. 26 is available from Morey Machinery Co., Inc., 410 Broome St., New York, N. Y.

"FOR GRINDER MEN ONLY"—issued as a part of the continuing Koebel program of service to the American industry in training inexperienced workers. Attractively set forth and illustrated with cartoons are helpful facts—boiled down for quick reference — on the correct method of dressing wheels. This Wheel Dressing Manual for grinder operators is available from Koebel Diamond Tool Co., 9347 Grinnell Ave., Detroit, Mich. Send for your copy.

NEW IMPROVED PROTRACTOR — Xactor, the new pocket-size protractor, is a timely contribution to the field of expert engineering, tool grinding and general machine work. With the Xactor, surface angles, such as are ground into tool bits, may be measured without the aid of attachments. Degree-graduations are so arranged that the component angle, as well as the direct angle, may be read directly. Further details are available in descriptive Bulletin P. Address Industrial Engineering Co., 141 W. Jackson Blvd., Chicago, Ill., for your copy.

TRUFORM OIL HARDENING NON-SHRINKABLE STEEL—is described in Bulletin 542, issued by Jessop Steel Co., 610 Green St., Washington, Pa. The four outstanding characteristics of Truform—non-shrinkable, greater hardness, exceptional toughness and machinability—are all discussed. Truform applications are illustrated and listed. Working data and charts showing tempering temperatures and effect of drawing temperature will also prove of interest.

THOMPSON UNIVERSAL MILLING FIXTURE — Designed especially for use on any standard bench lathe, can be efficiently used for milling punches, end mills, keyways and counterbores. Actual shop application photographs illustrate the folder "Thompson Universal Milling Fixture," available from Auto-Ordnance Corp., 342 W. Putnam Ave., Greenwich, Conn.

Hundreds of Users Prefer

Tru-Cut TOOL BITS

Where the

"GOING IS TOUGH"

Use Gold Tip and Blue Nose Bits on tough jobs like this and watch results.

Center Drills . . . Keyway Cutters . . . Dovetails . . . Form Ground Tools

Send for Catalog and Prices

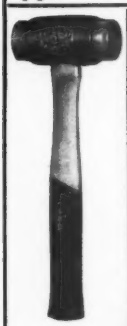
Tru-Cut TOOL COMPANY

14236 Birwood Detroit, Mich.

Specially treated to Rockwell "C" 62-65, and are not brittle.

Actual photo of Tru-Cut Gold Tip Bit. 11/16" cut, .020 Feed, 1020 SAE Steel.

Rawhide **HAMMERS** *Rawhide* **MALLETS**



• Genuine Java Water Buffalo Hide replaceable faces in malleable head.

No.	Dia. in ins.	Wgt. in lbs.
0	1	½
1	1¼	1⅛
2	1½	1⅝
3	1¾	2¼
4	2	4
5	2¾	5½

• A finely balanced Tool with tough, resilient Java Water Buffalo Rawhide heads.

Not Loaded				Loaded Mallets			
No.	Dia. Ins.	Lgt. Ins.	Wt. Ozs.	No.	Dia. Ins.	Lgt. Ins.	Wt. Ozs.
0	1	2⅛	2	7	1¼	3	8
1	1¼	3	3½	8	1½	3⅛	12
2	1½	3¼	6	9	1¾	3⅝	16
3	1¾	3¼	7½	10	2	3½	20
4	2	3½	10	11	2¾	4¼	42
5	2¾	4¼	21				
6	2¾	4¾	23				

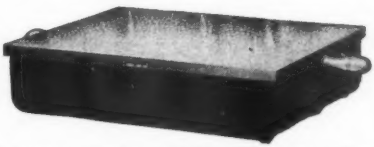
• These are the tough, resilient, long-lasting Rawhide faces made from specially treated Java Water Buffalo hide for use in Chicago Rawhide Hammers.

CHICAGO *Rawhide* MFG. CO.

1280 ELSTON AVE. ★ CHICAGO, ILLINOIS.

CHALLENGE DUPLEX BENCH BLOCKS

Made in three combinations . . . (1) one surface smooth and the other grooved for lapping ½-inch mesh (2) both sides smooth (3) both sides grooved. Semi-steel — precision ground, both top and bottom. Also furnished with either or both surfaces hand-scraped at extra cost. Provide double utility and can be used as a base for small fixtures and tools. One size, 10x14x2⅜-inches.



CHALLENGE SURFACE PLATES

A true surface for tool making, testing, and inspection. Built to retain accurate plane surface. Will not sag. Made of close-grained semi-steel—*hand-scraped.* Also furnished with precision ground surface. Felt lined wooden protective cover supplied with each plate. Write us today for full details. 421

LATEST CATALOG illustrates and describes the complete line of Challenge Precision Equipment. Send for it at once!

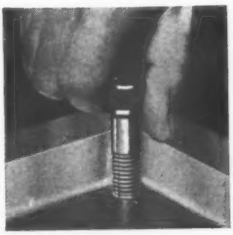
THE CHALLENGE MACHINERY CO.
GRAND HAVEN, MICHIGAN

REG. U.S. PAT. OFF.

UNBRAKO

*

KNURLED SOCKET HEAD CAP SCREWS



The "Unbrako" knurling prevents slipping, so the fingers, handiest of wrenches, can help to save time and pliers can be used to make adjustments where a wrench may not be applicable. Moreover, the *knurling* allows the screw to be *locked* after countersinking; however, screw can be backed out and used again and again. And, of course, "UNBRAKO" Screws go into close quarters—see illustration. This permits of more compact designs, lighter construction—and saving of material.

*Sizes: No. 4 to 1½" diameter

Write for Catalog

The knurling of Socket Screws originated with "Unbrako" years ago

STANDARD PRESSED STEEL CO.
Box 600, Jenkintown, Pa.
BOSTON · DETROIT · INDIANAPOLIS
CHICAGO · ST. LOUIS · SAN FRANCISCO

OLIVER

DIE MAKING MACHINES

THE basic needs of faster, smoother sawing and filing are met with the Oliver Die Making Machines. Operating efficiency is increased 50 to 60 per cent over hand methods in the making of precision dies, gages, cams, templates and similar products requiring rapid and accurate filing, sawing and lapping operations.

Send for literature describing the line of Oliver Die Making Machines!

•

OLIVER INSTRUMENT COMPANY

1436 Maumee St., E. -:- Adrian, Mich.

We also build Drill Grinders, Tool and Cutter Grinders, Face Mill Grinders, Template Tool Bit Grinders.

Shipment from warehouse

STOCK

HY-TEN

S.A.E. • A.I.S.I. • N.E.

ALLOY STEELS

Scientifically selected and designed to conserve critical alloys and meet the carburizing or heat treating requirements of the Machine Tool and Aircraft industries. Call our nearest office and warehouse for up-to-the-minute information.

WHEELOCK, LOVEJOY & CO., INC.

CAMBRIDGE • CLEVELAND

CHICAGO • NEWARK

DETROIT • BUFFALO

CINCINNATI

Grobet Moves to New Quarters

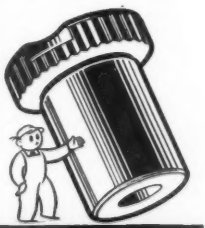
THE Grobet File Co. of America, distributors of Swiss Pattern Files and Rotary Files, announce their removal to larger quarters at 421 Canal Street, New York City.

UNIVERSAL FIRST COMPANY IN AMERICA TO WIN COVETED 20% BOND FLAG

When each of the 550 of us here at Universal helped give the Allied cause a boost by being America's first industrial plant to subscribe 20% for War Bonds we were mighty proud.

But we're even more proud of the big volume of precision built drill bushings we're turning out daily to help America's arms production.

Universal drill bushings (such as the one shown here) are straight and round with superfinished bores which assure accuracy and unexcelled wearing qualities. Write for facts.



UNIVERSAL
ENGINEERING COMPANY
FRANKENMUTH, MICH.

★ it's New

-Heavier-Accurate

A BIG VISE FOR THE BIG JOBS

It's new—larger—heavier—accurate! Designed and built to fill the need for precision on the big vise jobs. Note the heavy jaws, longer ways, broad base and extra swivel bearing surface of this Rousselle Victory Vise. Once swivel is set, it stays put! Built to cut set-up time in half—made in four sizes: 4½ in., 7 in., 10 in. and 13 in.

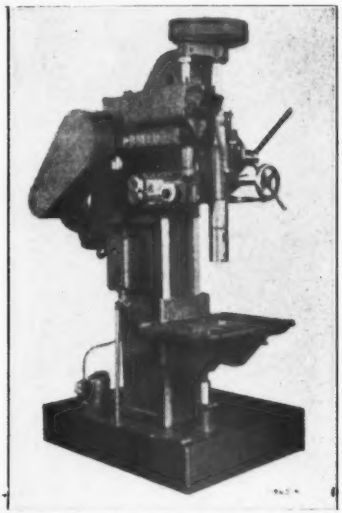
Write for Bulletin TD-112 and prices.

Preference rating certificate must accompany orders.

Dealers: A few select territories still available.

DAVID J. ROSS CO.
BENTON HARBOR, MICH.

BAKER HEAVY DUTY DRILLS



Geared and Hydraulic Feeds

MODEL NO. 314-A

Mechanical Feed, Single Spindle, Universal Quick Change Type Heavy Duty Drilling Machine having Heavy Multi-Splined Spindles.

Speed Box Gears finished by shaving and "Fellow" Flame Hardening.

Two-piece vertical column design.

Capacity up to 3" diameter drill in solid steel (SAE 1035)

New Descriptive Circular Available.

Baker Bros., Inc.
TOLEDO **OHIO**

GAGES FOR WAR!

Large Shell Cases Must Conform To Close Limits.

Our skilled mechanics, working with our complete precision equipment, are fully capable of producing the kind of gages, dies and tools that help keep the War Production System in high gear.

FEDERAL TOOL CORPORATION
400 North Leavitt Street Chicago, Illinois

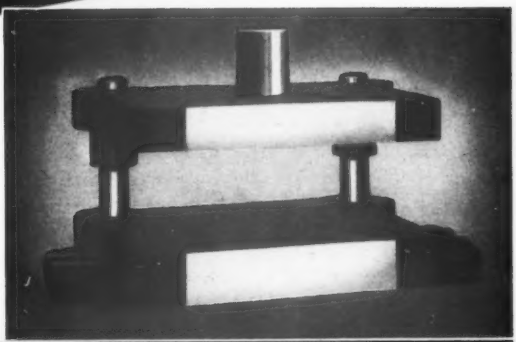
DETROIT DIE SETS ★

STANDARD DIE SETS
and ACCESSORIES
in stock for
immediate shipment.

●

PRECISION DIE SETS
SPECIAL DIE SETS
DOWEL PINS, SPRINGS
SOCKET-HEAD CAP SCREWS
and CAP SCREWS

Write for Catalog.

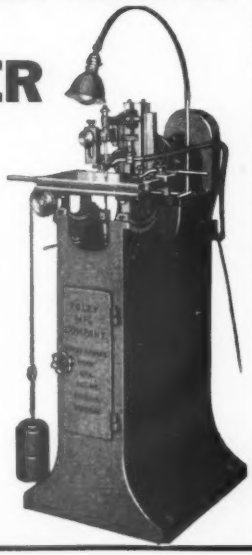


DETROIT DIE SET CORP. 2895 W. GRAND BLVD
DETROIT, MICHIGAN

The **ONLY** Machine Using **HIGH SPEED BLADES**

for High Carbon High Chrome
Steel up to 3 Inches Thick

FOLEY DIE MAKER



Handles most intricate dies with small holes and sharp corners, as only smallest lead hole through which saw or file can pass is necessary. Compound angle filing is fast, accurate and easy with the **Foley Die-Making Machine.** Adjustable table tilts 20° front, 10° back. Ram tilts 20° right or left. Has 6⅜" throat—saws to center of 12¾" piece.

USES ANY STANDARD OR SPECIAL FILES—From the smallest needle file to the coarsest bastard file can be used in this machine without any special holding fixtures.

TAKES ANY SAW—Any type of saw from the finest saw to the high power high speed saw can be used without delay of changing holding fixtures. No holes in blade necessary.

PAYS FOR ITSELF. The **Foley Die-Making Machine usually pays for itself in 400 working hours.** Write today for literature and full details.

FOLEY MFG. CO. 4 Main Street, N. E. Minneapolis, Minn.

Manufacturers of Foley Automatic Saw Filers, Grinders, etc.

PRECISION GAGE MAKERS

We have designed and built special gages of every type and description for a number of leading production manufacturers. Our facilities for designing and making precision gages and dies are among the best.

Continuous special training of skilled craftsmen assures the finest precision work to meet the most rigid specifications of leading users of precision gages, gaging fixtures and small stamping dies.

★ ★ ★

TOOLS & GAGES, INC.
3112 East 63rd Street
Cleveland, Ohio

PROMPT DELIVERY
Write For Catalog

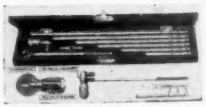
WILLEY'S
CARBIDE TOOL CO.
MANUFACTURERS AND SPECIALISTS IN
TUNGSTEN CARBIDE TOOLS
1146 W. VERNOR HIGHWAY • DETROIT, MICHIGAN

M & L PRECISION TAPPER

Taps guided by precision leads Class 3 & 4 specifications easily met. 4 speeds ball bearings throughout. Available as floor model (with coolant system) or table model.

International Inside Micrometers

Highest accuracy and finest workmanship. Available 1½"—6" & 1½"—12" sets.



Brand Telescope Gages ½"—2⅛" Handy Knurler, used like pair of pliers.

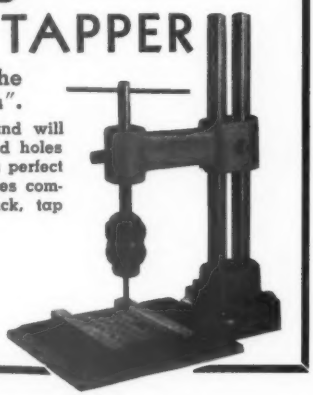
BRAND TOOL & SUPPLY CO.
346 No. Vermont Ave. Los Angeles, Cal.

BERGER
SENSITIVE HAND TAPPER

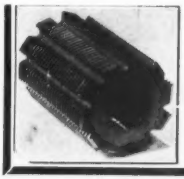
for hand tapping of delicate threads in the tool room, from the smallest up to ¼".

This handy device is precision-built and jig-bored and will positively eliminate expensive tap breakage or spoiled holes on costly work. The lapped spindle and guide assures perfect alignment in any position of the tap. The tapper comes complete with two work-holding jaws, special tap chuck, tap holder block and wrenches.

The Berger may pay for itself on the first job. Get one today.



MARBURG BROTHERS, INC.
88-92 West St., NEW YORK

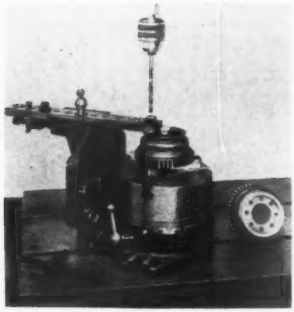


MULTIPLE THREAD MILLING HOBS

In any thread system, any thread angle, any thread form. Up to 7" O.D. and 4" thread length for external or internal threading.
Tolerances: Cut on machines adjustable for tolerances up to 1/10,000".
All hobs demagnetized, relieving chips immediately.
"For quick action call plant at Clinton, Indiana, Telephone 85"
DELIVERY TIME: from one week on.

U. S. MACHINE TOOL MFG. CORPORATION
106 SOUTH SIXTH STREET **TERRE HAUTE, INDIANA**

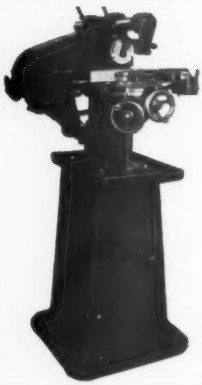
★ **THE HARTFORD SUPER-SPACER**



***is versatile*—It speeds drilling, milling, slotting and planing operations without sacrificing accuracy. It is equally adaptable for special work or for production. Because the design is simple and fool-proof, any man in the shop can operate the Super-Spacer in his stride. Your shop can keep at least one busy.**

Tool Room Circular TD-3 on request

THE HARTFORD SPECIAL MACHINERY CO.
281 HOMESTEAD AVE. · HARTFORD, CONN.



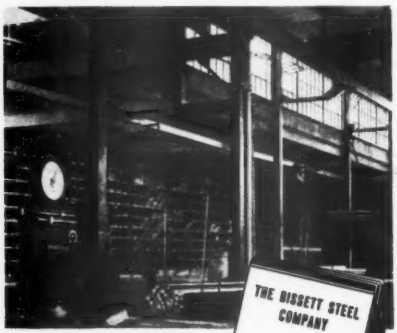
BURKE

MILLING MACHINES and ATTACHMENTS

Designed especially for the profitable handling of small and difficult work on a production basis. Burke Milling Machines are available in sizes Nos. 1, 2, 3 and 4, all motor driven.

Illustrated No. 4 Motor Driven Machine mounted on cabinet column. Write for complete details.

BURKE MACHINE TOOL CO.
301 E. 16th St. Conneaut, Ohio



MORE KINDS OF
STEEL
AND MORE OF IT
In the
New Bissett Warehouse

This free, 110-page, reference catalog has listings and data of Bissett's complete supplies of the finest steels. Send for it today!

★ ★ ★ ★ ★

IN WAREHOUSE:

Aircraft Steels ★ Alloy Steels ★ Ball Bearing Steel ★ Boiler Tubes ★ Chisel Steel ★ Cold Finished Steels ★ Cumberland Ground Shafts ★ Drill Rod ★ High Speed Tool Bits ★ S.A.E. Steels ★ Shim Steel ★ Strip Steels ★ Spring Steels ★ Tool Steels ★ Tool Steel Tubing

BISSETT Steel
945 E. 67th St. ★ Cleveland, Ohio ★ HEnderson 0995

Geared for Victory!

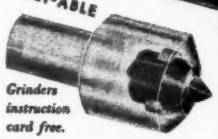
BEVEL — SPUR
WORM — HELICAL

The TAYLOR MACHINE Co.
1917 E. 61st Street
Cleveland, Ohio

"TAYLOR-MADE"

DIAMONDS *for Victory*

BIG-HED-NIBS
LOC-KEY-SET
RE-SET-ABLE



Grinders instruction card free.

Cooler dressing
Closer tolerances
Micrometer Accuracy

Because: Wing key heat dissipation and absolute diamond lock nib.

● Three grades of diamonds. Common quality $12 per karat. Medium quality $24 per karat. Select quality $48 per karat. (Contour template diamonds supplied only in Medium and Select quality.)

All diamond sizes ¼ to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. We recommend a minimum size of one karat for each 6" diameter of grinding wheel. (24 hour resetting service, $1.00 post paid.)

Send specifications and prints for prices on turning and boring form tools.

DIAMOND TOOL COMPANY, Not Inc.
Sheldon M. Booth, Pres.
935 E. 41st Street CHICAGO, ILL.

PLASTIC NAME PLATES

Dial Faces, Charts, Instruction Plates, Scales, Etc.

PRINTED AND LAMINATED VINYLITE OR CELLULOSE ACETATE
TOUGH, NON-INFLAMMABLE, PERMANENT PLASTIC MATERIALS

Let Us Estimate Your Requirements . . . Write for Samples and Prices.

THE HOPP PRESS, INC.

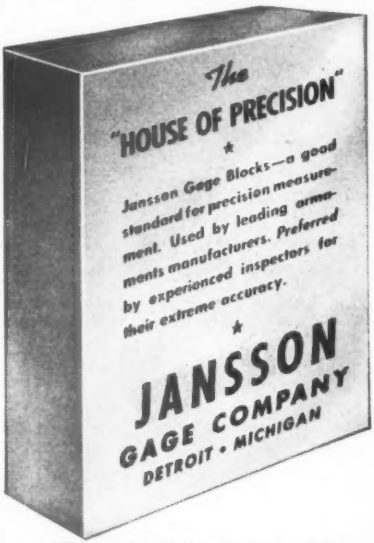
460 W. 34th STREET DEPT "T" NEW YORK, N.Y.

ANNOUNCING "AIR-CLAMP"

For Greater Drill-Press Output

Wherever a drill comes down, something must hold the work. Wherever a drilling-jig is required, *Air-Clamp* will simplify it. Wherever *speed* is desired, *Air-Clamp* will produce it. *Air-Clamp* holds with relentless pressure; is undisturbed by size variations (such as in castings), it scoffs at vibration (how many drills have been broken due to faulty hold-downs?), chatter, snagging. *Air-Clamp* holds work of any size or shape in any position, at any angle. It can pay for itself on a single fixture; it can save its cost on a few days' drill-press output. Reduces operator-fatigue. Saves hours and dollars in drafting room, jig department, tool room and production line. *Air-Clamp* fits any drill-press having a cylindrical column. Special fixtures for Tee-slotted tables, light milling work, etc. Hand and/or foot control. Shipped on approval to responsible concerns.

MEAD SPECIALTIES COMPANY
15 S. Market St., Dept. 10-HA, Chicago, U.S.A.


The
"HOUSE OF PRECISION"
★
Janssen Gage Blocks—a good standard for precision measurement. Used by leading armaments manufacturers. Preferred by experienced inspectors for their extreme accuracy.
★
JANSSON
GAGE COMPANY
DETROIT • MICHIGAN

Write for Literature and Prices

19212 GLENDALE AVE.

PRODUCTION GOES UP...COSTS COME DOWN

THIS improved type band grinder speeds production in war plants throughout the country. Built to machine tool specifications, the Simplex-M eliminates expensive, slow, hand emerying and filing. It assures a perfect, straight grain, sharp-edged finish on metals, plastics, wood and fibre. Whether your plant is large or small . . . investigate the economies of Simplex-M, today!

Informative Booklet on Finishing ★ Write Today

WALLS SALES CORP., 97 Warren St., New York, N. Y.

SIMPLEX-M ABRASIVE BAND GRINDER

BUY WITH CONFIDENCE

A directory of products, listing for ready reference the names of manufacturers and dealers whose sales to The TOOL & DIE Journal readers have established them as dependable in every sense of the word. They merit your consideration. Complete information about any product may be had upon request made to the firm listed or to us. Your mention of The TOOL & DIE Journal will be appreciated.

ABRASIVE CUT-OFF MACHINES
Bridgeport Safety Emery Wheel Co., 1301 W. Broad St., Bridgeport, Conn.

ABRASIVE PAPER AND CLOTH
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass. (Behr-Manning Div.)
Walls Sales Corp., 97 Warren St., New York, N. Y.

ASSEMBLING MACHINES—Automatic
Sommer & Adams Co., The, 18511 Euclid Ave., Cleveland, O.

BENCH CENTERS
American Gauge Co., The, 128 Bayard St., Dayton, O.

BENCHES
Challenge Machinery Co., Grand Haven, Mich.

BENDERS—Metal
O'Neil-Irwin Mfg. Co., 315 8th Ave., So., Minneapolis, Minn.

BLADES—Centerless Grinder
Metal Carbides Corp., Youngstown, O.

BLADES—Cutting Off
Empire Tool Co., 8780 Grinnell Ave., Detroit, Mich.

BLOWERS
Johnson Gas Appliance Company, 560 E Avenue, N.W., Cedar Rapids, Ia.

BOLTS—Stripper
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 4751 Hough Ave., Cleveland, O.
Holo-Krome Screw Corp., Hartford, Conn.
Manufacturers Supply Co., 2640 Carnegie Ave., Cleveland, O.

BOLTS—T-Slot
Boyar-Schultz Corp., 2112-M Walnut St., Chicago, Ill.

BORING BARS
State Mfg. & Construction Co., Franklin, O.

BORING HEADS—Offset
Precision Tool Co., The, P. O. Box 155, Brooklyn, N. Y.

BORING MILL—Horizontal
DeVlieg Machine Co., 450 Fair Ave., Ferndale, Mich.
Yoder Sales Co., Cleveland, O.

BORING TOOLS
Bokum Tool Co., 14775 Wildemere Ave., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Roosevelt Park Annex, Detroit, Mich.
Park Ave., Sycamore, Ill.

BRAKES
O'Neil-Irwin Mfg. Co., 315 8th Ave., Minneapolis, Minn.

BROACHING MACHINES
American Broach & Machine Co., Ann Arbor, Mich.
Colonial Broach Co., 147 Jos. Campau St., Detroit, Mich.

BURNERS—Gas
Johnson Gas Appliance Company, 560 E Avenue, N.W., Cedar Rapids, Ia.

BURS—Rotary
Martindale Electric Co., 1417 Hurd Ave., Cleveland, O.

BUSHINGS—Die
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 4751 Hough Ave. Cleveland, O.

BUSHINGS—Drill
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Colonial Bushings, Inc., 145 Jos Campau St., Detroit, Mich.
Universal Engineering Co., Frankenmuth, Mich.

CALIPERS
Lufkin Rule Co., Saginaw, Mich.
Starrett Company, L. S., Athol, Mass.

CAMS
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.

CARBIDE TOOLS AND BLANKS
Carboloy Company, 11109 E. Eight Mile Rd., Detroit, Mich.
Ex-Cell-O Corporation, 1202 Oakman Blvd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Company, 500 Lloyd Ave., Latrobe, Pa.
Willey's Carbide Tool Co., 1340 W. Vernor Highway, Detroit, Mich.

CARBIDE TOOLS—Sintered
Firth-Sterling Steel Co., McKeesport, Pa.

CASTINGS—Air and Oil Hardening Tool Steel Cast to Shape
Forging and Casting Corp., The, Ferndale (Detroit), Mich.

CASTINGS—Nitri-Cast-Iron
Forging and Casting Corp., The, Ferndale (Detroit), Mich.

CENTER DRILLS
Tru-Cut Tool Co., 14236 Birwood Detroit, Mich.

CENTERS
Chicago Manufacturing & Distributing Co., Dept. J-11, 1928 W. 46 St., Chicago, Ill.
Ideal Commutator Dresser Co., 4153 Park Ave., Sycamore, Ill.

CERROBEND
Cerro de Pasco Copper Corp., 40 Wall St., New York, N. Y.

CERROMATRIX
Cerro de Pasco Copper Corp., 40 Wall St., New York, N. Y.

CHILL CHESTS
Kold-Hold Manufacturing Co., 445 N. Grand Ave., Lansing, Mich.
Revco, Inc., Adrian, Mich.

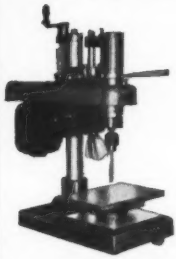
CHUCKS—Collet
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Tomkins-Johnson Co., The, 630 North Mechanic St., Jackson, Mich.
Universal Engineering Co., Frankenmuth, Mich.

CLAMPS
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Detroit Stamping Co., 344 Midland Ave., Detroit, Mich.
Gibson Co., The Wm. D., 1800 Clybourn Ave., Chicago, Ill. (Div. of Associated Spring Corp.)
Knu-Vise, Incorporated, 1332 Plum St., Detroit, Mich.
Mead Specialties Co., 15 So. Market St., Dept. 9-HA, Chicago, Ill.

CLAMPS—Die
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.

CLAMPS—Toggle
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Detroit Stamping Co., 344 Midland Ave., Detroit, Mich.
Knu-Vise, Incorporated, 1332 Plum St., Detroit, Mich.

CLIPS
Gibson Co., The Wm. D., 1800 Clybourn Ave., Chicago, Ill. (Div. of Associated Spring Corp.)



Precision-built for tiny precision drilling

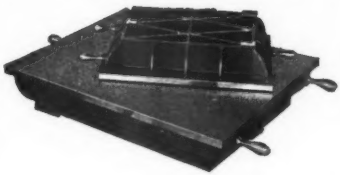
The HAMILTON MUEHLMATT *Super Sensitive* DRILLING MACHINE

UNSURPASSED for holes from .004 to 5/16" dia. Self-contained drilling unit, swings radially on column, locks to any position. Helps save those irreplaceable small drills.

Dept. T-11

THE HAMILTON TOOL CO.
Ninth and Hanover Streets.
HAMILTON OHIO

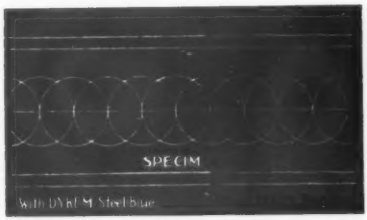
MILWAUKEE SURFACE PLATES



A full line of surface plates, angles and box parallels. Standard plate sizes from 8" x 12" to 48" x 96", larger sizes with or without legs. Plates are finish-planed and scraped to insure a very accurate surface.

Write for details

J. C. BUSCH CO.
Engineers and Machinists Since 1907
172 SO. FERRY ST., MILWAUKEE, WIS.



DYKEM STEEL BLUE *STOPS LOSSES* making dies & templates

Simply brush on; ready for the layout in a few minutes. The dark blue background makes the layout lines show up in a sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information.

THE DYKEM COMPANY
2201 N. 11th STREET ST. LOUIS, MO.

EVANS *High Speed Steel* REAMERS

LOOK AT THESE FEATURES

- No honing.
- Will not chatter.
- Chrome-like finish.
- Perfect alignment.
- Full bearing surface.
- Left and right spirals.
- 50 to 80 thousandths expansion.
- Cannot fail in slots or oil grooves.
- Extension pilots for line-up work.

WILL SHIP ON 30 DAYS' TRIAL | **EVANS FLEXIBLE REAMER CO.** 4543 Ravenswood Ave. Chicago, Ill. | WRITE FOR CIRCULAR

CLUTCHES
Conway Clutch Co., P.O. Station B., Cincinnati, O.

COLLET INDEX FIXTURES
Hardinge Brothers, Inc., Elmira, N. Y.
Zagar Tool, Inc., 23881 Lakeland Blvd., Cleveland, O.

COLLETS—Lathe and Milling Machines
Hardinge Brothers, Inc., Elmira, N. Y.
Precision Collet Co., 265 Canal St., New York, New York
Rivett-Lathe & Grinder, Inc., Brighton, Boston, Mass.

COMPOSITE DIE SECTION STEEL
Firth-Sterling Steel Co., McKeesport, Pa.
Forging and Casting Corp., The, Ferndale, Mich.
Jessop Steel Co., 610 Green St., Washington, Pa.

COOLANT SYSTEMS
Gray-Mills Co., 211 W. Ontario St., Chicago, Ill.

CONTOUR METAL-WORKING MACHINES
Continental Machines, Inc., 1303 S. Washington Ave., Minneapolis, Minn.

COUNTERBORES
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Roosevelt Park Annex, Detroit, Mich.
Putnam Tool Co., 2985 Charlevoix Ave., Detroit, Mich.

COUNTERSINKS
Gairing Tool Co., Roosevelt Park Annex, Detroit, Mich.

COUPLINGS—Flexible
Smith Power Transmission Co., 1545 E. 23 St., Cleveland, O.

CRANES
American MonoRail Co., 13131 Athens Ave., Cleveland, Ohio

CUTTERS—Boring
Gairing Tool Co., Roosevelt Park Annex, Detroit, Mich.

CUTTERS—Die Sinking
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
Tomkins-Johnson Co., The, 630 North Mechanic St., Jackson, Mich.

CUTTERS—Hard Carbide
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa.

CUTTERS—Milling
Ex-Cello-O Corp., 1202 Oakland Blvd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., The, Roosevelt Park Annex, Detroit, Mich.
Martindale Electric Co., 1417 Hird Ave., Cleveland, O.
Putnam Tool Co., 2985 Charlevoix Ave., Detroit, Mich.
Severance Tool Co., 1506 E. Genesee Ave., Saginaw, Mich.
Tomkins-Johnson Co., The, 630 North Mechanic St., Jackson, Mich.

CYLINDERS—Hydraulic
Tomkins-Johnson Co., The, 630 North Mechanic St., Jackson, Mich.

CYLINDERS—Pneumatic
Tomkins-Johnson Co., The, 630 North Mechanic St., Jackson, Mich.

DEMAGNETIZERS
Alofs Mfg. Co., 1619 Madison Ave., S.E., Grand Rapids, Mich.
L-W Chuck Co., 1 North St., Toledo, O.
Welch Industries, Inc., 20000 W. Eight Mile Rd., Detroit, Mich.

DESIGNING AND DRAFTING
Package Machinery Co., Springfield, Mass.

DIAMOND STONES
Carborundum Co., Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

DIAMOND TOOLS
American Diamond Tool and Gauge Co., 15924 Woodingham, Detroit, Mich.
Christensen Diamond Tool Co., 3688 E. Willis, Detroit, Mich.
Diamond Tool Co., 937 E. 41st St., Chicago, Ill.
Koebel Diamond Tool Co., 9347 Grinnell Ave., Detroit, Mich.

DIAMOND WHEELS
Carborundum Co., Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

DIE CENTERS—Hard Carbide
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa.

DIE CUSHIONS—Pneumatic
Dayton-Rogers Mfg. Co., Minneapolis, Minn.

DIE FILING MACHINES
Atlas Equipment Co., 101 S. Clinton St., Chicago, Ill.
Illinois Tool Works, 2503 N. Keeler Ave., Chicago, Ill.
Industrial Engineering Co., 141 W. Jackson Blvd., Chicago, Ill.
Marburg Bros., Inc., 88-92 West St., New York, N. Y.
Oliver Instrument Co., 1436 Maumee St., E., Adrian, Mich.

DIE HANDLING TRUCKS
Hamilton Tool Co., Ninth and Hanover Sts., Hamilton, O.

DIE MAKERS SUPPLIES
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.

DIE MAKING MACHINES
Continental Machines, Inc., 1303 S. Washington Ave., Minneapolis, Minn.
Harvey Manufacturing Corp., 163 Grand Jt., New York, N. Y.
Oliver Instrument Co., 1436 Maumee St., E., Adrian, Mich.

DIE SECTIONS—Composite Steel
Forging and Casting Corp., Ferndale (Detroit), Mich.
Jessop Steel Co., 610 Green St., Washington, Pa.

DIE SECTIONS—Forged
Ajax Steel and Forge Co., 205 Adair St., Detroit, Mich.
Forging and Casting Corp., The, Ferndale, Mich.

DIE SET MACHINES
Marburg Bros., Inc., 88-92 West St., New York, N. Y.

DIE SETS
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Detroit Die Set Corp., 2895 W. Grand Blvd., Detroit, Mich.
Die Supply Co., 4751 Hough Ave., Cleveland, O.
Producto Machine Co., The, 990 Housatonic Ave., Bridgeport, Conn.

DIE STEEL—See Steel Tool & Die

DIE SUBSTITUTE MACHINES
O'Neil-Irwin Mfg. Co., 315 8th Ave., So., Minneapolis, Minn.

DIE TRUCK
Modern Motor Drives, Inc., Elkhart, Ind.

DIES—Adjustable
Whistler & Sons, Inc., S. B., 752-756 Military Rd., Buffalo, N. Y.

DIES—Carbide
Tungsten Electric Corp., 574 39th St., Union City, N. J.

DIES—Punching and Notching
Strippit Corporation, The, Buffalo, N. Y.
Whistler & Sons, Inc., S. B., 752-756 Military Rd., Buffalo, N. Y.

DOWEL PINS
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Detroit Die Set Corp., 2895 W. Grand Blvd., Detroit, Mich.
Die Supply Co., 4751 Hough Ave., Cleveland, O.
Manufacturers Supply Co., 2640 Carnegie Ave., Cleveland, O.

DRAWING COMPOUNDS
Gilron Products Co., 1555 E. 40th St., Cleveland, O.

DRESSERS—DIAMOND
American Diamond Tool and Gauge Co., 15924 Woodingham, Detroit, Mich.
Carboloy Co., Inc., 11109 E. 8 Mile Rd., Detroit, Mich.

DRESSERS—Quick Angle
Welch Industries, Inc., 20000 W. Eight Mile Rd., Detroit, Mich.

DRESSERS—Radius
American Gauge Co., 128 Bayard St., Dayton, O.
Golconda Diamond Products Corp., 3856-58 N. Ashland Ave., Chicago, Ill.
Kopec Engr. Co., S. J., 17113 W. McNichols Rd., Detroit, Mich.

DRESSING STICKS
Carborundum Co., Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

DRILL GRINDING FIXTURE
Industrial Engineering Co., Inc., 141 W. Jackson Blvd., Chicago, Ill.

DRILL HEADS
Michigan Industrial Sales Co., 134 Duffield, Detroit, Mich.

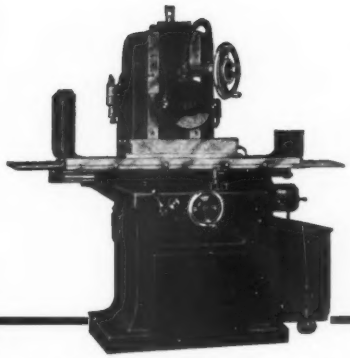
DRILL HEADS—Adjustable
Linderme Machine and Tool Co., 12250 Coyle Ave., Detroit, Mich.

DRILL JIG—Toggle Action
Knu-Vise, Incorporated, 1332 Plum St., Detroit, Mich.

DRILL JIG BUSHINGS
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Colonial Bushings, Inc., 145 Jos. Campau St., Detroit, Mich.
Universal Engineering Co., Frankenmuth, Mich.

DRILL POINTERS
Oliver Instrument Co., 1436 E. Maumee St., Adrian, Mich.

DRILL PRESSES
Baker Bros., Inc., Toledo, O.
Delta Mfg. Co., 612-M East Vienna Ave., Milwaukee, Wis.
Duro Metal Products Co., Dept. TP-21, 2649 N. Kildare Ave., Chicago, Ill.
Hamilton Tool Co., Ninth and Hanover Sts., Hamilton, O.



Grand Rapids Surface Grinders are the result of over thirty years actual experience in the building of precision grinding equipment . . . A patented vertical head adjustment is featured. When using the circular Vernier reading for extreme accuracy, the graduated circular plate can be set at zero in relation to the pointer extending inward from the rim of the large hand wheel. The pointer will travel in the same direction as the small inner hand wheel, but at ⅛th the speed . . . Attractive and amply illustrated Bulletin GL-100 is available.

GALLMEYER & LIVINGSTON CO.
304 Straight Ave., SW Grand Rapids, Mich.

"TRU-V" BLOCKS

Why Not Save Time — by having enough V-Blocks available at all times in your shop to avoid the delays involved in make-shift set-ups and tie-ups?

"TRU-V" Cast-Iron Blocks are available in nine sizes—from 3½ to 10" in three styles. Each block is carefully machined on all sides, with close limits held within .001" where required. A machined ledge on both sides provides for clamping on machine bed.

Let us send descriptive bulletin.
Or contact your mill supply dealer.

Oliver Motorcraft Corp.
2536 S. Wabash Ave., Chicago, Ill.

RUTHMAN
GUSHER
COOLANT PUMPS

Model 11020-A

EXCLUSIVE ADVANTAGES

Gusher Pumps give you *patented* features no other coolant pump can offer.

There's a Gusher Pump to fit your needs. Write for data and specifications.

THE RUTHMAN MACHINERY CO.
1808 Reading Road Cincinnati, Ohio
Largest Exclusive Builders of Coolant Pumps

ARMSTRONG
SYSTEM of TOOL HOLDERS

Save: all Forging
70% Grinding
90% High Speed Steel

A complete system of permanent multi-purpose tools, each of which does the work of a complete set of forged tools . . tools for every operation on lathes, planers, slotters and shapers that take cutters any mechanic can quickly grind from stock shapes of high speed steel.

Write for Catalog C-39

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
340 N. Francisco Ave., Chicago, U.S.A.

Eastern Warehouse & Sales:
199 LaFayette St., New York

DRILL TABLES
Kelly Co., The O. S., Dept. JK, Springfield, O.

DRILLING MACHINES—Automatic
Sommer & Adams Co., The, 18511 Euclid Ave., Cleveland, O.

DRILLS—Hardsteel
Black Drill Co., 5005 Euclid Ave., Cleveland, O.

DRILLS—Portable
Skilsaw, Inc., 5061 Elston Ave., Chicago, Ill.

DRILLS—Production
Kelly Co., The O. S., Dept. JK, Springfield, O.

DRILLS—Twist
Cleveland Twist Drill Co., 1242 E. 49 St., Cleveland, O.

DRIVE UNITS—Motorized
Berkeley Equipment Co., Corry, Pa.
Cullman Wheel Co., 1332 Altgeld St., Chicago, Ill.
Drive-All Mfg. Co., 3400 Conner Ave., Detroit, Mich.

DRIVES—Gearshift
Lima Electric Motor Co., The, Lima, O.

DUPLICATOR MACHINES
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
O'Neil-Irwin Mfg. Co., 315 8th Ave., Minneapolis, Minn.

ELECTRIC MOTORS
Lima Electric Motor Co., Lima, O.

ELEVATING TABLES—Portable
Hamilton Tool Co., The, Ninth and Hanover Sts., Hamilton, O.

END MILL HOLDERS
Rusnok Tool Works, 4840 W. North Ave., Chicago, Ill.

END MILLS
Tomkins-Johnson Co., The, 630 N. Mechanic St., Jackson, Mich.
Putnam Tool Co., 2985 Charlevoix Ave., Detroit, Mich.

ENGINEERING SERVICE
McKinney Tool & Manufacturing Co., 1688 Arabella Rd., Cleveland, O.

ETCHED PLASTICS
Eastern Etching & Mfg. Co., Grape St., Chicopee, Mass.
Hopp Press, Inc., The, 460 W. 34th St., Dept. T, New York, N. Y.

EXTRACTOR—Broken Tap
Walton Co., The, 88 Allyn St., Hartford, Conn.

FILES—Band
DoAll Co., Inc., 1203 Thacker St., Des Plaines, Ill.

FILES—Rotary
Grobet File Company of America, 412 Canal St., New York, N. Y.
Hamilton Tool Co., The, Ninth and Hanover Sts., Hamilton, O.
Martindale Electric Co., 1417 Hird Ave., Cleveland, O.
Severance Tool Co., 1506 E. Genesee Ave., Saginaw, Mich.

FILES—Swiss Pattern
Grobet File Company of America, 412 Canal St., New York, N. Y.

FILING MACHINES—Continuous
Continental Machines, Inc., 1303 Washington Ave., S., Minneapolis, Minn.

FILING MACHINES—Die and Punch
Marburg Bros., Inc., 88-92 West St., New York, N. Y.

FLAME HARDENING
Lakeside Steel Improvement Co., 5418 Lakeside Ave., Cleveland, O.

FLOATING HOLDERS—Screw Machine
Ajax Engr. & Mfg. Co., 14230 Birwood Ave., Detroit, Mich.

FORGINGS—Water and Oil Hardening
Forging and Casting Corp., Ferndale (Detroit), Mich.

FURNACES—Case Hardening
Cooley Electric Mfg. Co., 215 S. Senate Ave., Indianapolis, Ind.
Johnson Gas Appliance Co., 560 E Ave., N.W., Cedar Rapids, Ia.

FURNACES—Electric Heat Treating
Cooley Electric Mfg. Corp., 215 S. Senate Ave., Indianapolis, Ind.

FURNACES—High Speed Steel
Cooley Electric Mfg. Co., 215 S. Senate Ave., Indianapolis, Ind.
Johnson Gas Appliance Co., 560 E Avenue, N.W., Cedar Rapids, Ia.

FURNACES—Tempering and Drawing
Cooley Electric Mfg. Co., 215 S. Senate Ave., Indianapolis, Ind.
Despatch Oven Co., 600 S.E. Ninth St., Minneapolis, Minn.
Johnson Gas Appliance Co., 560 E Avenue, N.W., Cedar Rapids, Ia.

GAGE BLOCKS
Dearborn Gage Co., 22034 Beech St., Dearborn, Mich.
Jansson Gage Co., 19212 Glendale, Detroit, Mich.
Scherr Co., George, 128-B Lafayette St., New York, N. Y.
Webber Gage Co., 12903 Triskett Rd., Cleveland, O.

GAGE HANDLES
Federal Tool Corp., 400 N. Leavitt St., Chicago, Ill.

GAGES—Carbide Tipped
McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa.

GAGES—Center, Depth, Planer Telescoping, Surface, etc.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

GAGES—Dial
Starrett Co., L. S., Athol, Mass.

GAGES—Index Master
Bunell Machine and Tool Co., 1620 E. 24 St., Cleveland, Ohio.

GAGES—Multiple Checking
Federal Products Corp., 1 Reservoir St., Providence, R. I.
Vickers Broach & Gage Co., 1009-15 Franklin St., Detroit, Mich.

GAGES—Plain Cylindrical Plug
Lauer Tool & Gauge Co., 14265 Birwood, Detroit, Mich.
Perfex Gage & Tool Co., 3601 Gaylord, Detroit, Mich.
Turner Gauge Grinding Co., 2624 Hilton Rd., Detroit, Mich.
Vickers Broach & Gage Co., 1009-15 Franklin St., Detroit, Mich.

GAGES—Plug
United Precision Products Co., 3516 W. Belmont Ave., Chicago, Ill.

GAGES—Precision
Perfex Gage and Tool Co., 3601 Gaylord, Detroit, Mich.
Tools & Gages, Inc., 3112 E. 63rd St., Cleveland, O.
Turner Gauge Grinding Co., 2624 Hilton Rd., Detroit, Mich.
Vickers Broach & Gage Co., 1009-15 Franklin St., Detroit, Mich.

GAGES—Snap
Lauer Tool & Gauge Co., 14265 Birwood, Detroit, Mich.
Perfex Gage & Tool Co., 3601 Gaylord, Detroit, Mich.
Turner Gage Grinding Co., 2624 Hilton Rd., Detroit, Mich.

GAGES—Thread
Perfex Gage & Tool Co., 3601 Gaylord, Detroit, Mich.

GAGES—Tool Setting
Barteit Engineering Co., 1214 Partridge Ave., Beloit, Wisc.
Vickers Broach & Gage Co., 1009-15 Franklin St., Detroit, Mich.

GEARS—Special
Taylor Machine Co., 1917 E. 61st, Cleveland, O.

GRINDERS—Abrasive Band and Disk
Walls Sales Corp., 97 Warren St., New York, N. Y.

GRINDERS—Carbide
Baldor Electric Co., 4305 Duncan Ave., St. Louis, Mo.
Delta Mfg. Co., 612 M East Vienna Ave., Milwaukee, Wis.
Hammond Machinery Builders, Inc., 1631 Douglas Ave., Kalamazoo, Mich.

GRINDERS—Cutter
Douglas Machinery Co., 150 Broadway, New York, N. Y.
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
Norton Company, Worcester, Mass.
Oliver Instrument Co., 1436 Maumee St., E., Adrian, Mich.

GRINDERS—Cylindrical
Norton Company, Worcester, Mass.

GRINDERS—Face
Bridgeport Safety Emery Wheel Co., 1301 W. Broad St., Bridgeport, Conn.

GRINDERS—Hand
Chicago Wheel and Mfg. Co., 1101 W. Monroe St., Dept. TD, Chicago, Ill.
Dumore Company, Dept. 372-J, Racine, Wis.
Duro Metal Products Co., 2649 N. Kildare Ave., Dept. TP-21, Chicago, Ill.
Foredom Elec. Co., 27 Park Place, New York, N. Y.
Martindale Electric Co., 1417 Hird Ave., Cleveland, O.

GRINDERS—Hydraulic Feed
Gallmeyer & Livingston Co., 304 Straight Ave., S.W., Grand Rapids, Mich.

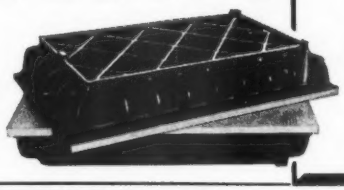
GRINDERS—Internal
Leach Machinery Co., H., 385 Charles St., Providence, R. I.
Majestic Tool & Mfg. Co., 2946 Woodbridge St., E., Detroit, Mich.
Say-Way Tool & Machining Co., 13836 Jos. Campau Ave., Detroit, Mich.

GRINDERS—Portable
Dumore Co., Dept. 372-J, Racine, Wis.
Martindale Electric Co., 1417 Hird Ave., Cleveland, O.

GRINDERS—Precision for Contours
Baker Brothers, Inc., Toledo, O.
Boyar-Schultz Corp., 2112-M Walnut St., Chicago, Ill.
Savage Tool Company, Dept. TD, Savage, Minn.

GRINDERS—Surface
Atlantic Machinery Corp., 149 Broadway, New York, N. Y.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., 304 Straight Ave., S.W., Grand Rapids, Mich.
Norton Company, Worcester, Mass.

REID MASTER PLATES



A NECESSITY IN EVERY PLANT WHERE ACCURACY IS DESIRED

THOROUGHLY NORMALIZED and **WEATHER SEASONED.**
PLANED & SCRAPED on same 3-**POINT BEARING** on which they will rest in use.
GUARANTEED ACCURACY within .0003" on a 24" x 36" size.
AVAILABLE PLANED and **SCRAPED** in standard sizes 12" x 18" to 36" x 72".
THE ONLY PLATE that has a 50% trade in value when purchasing a new **REID** plate.
Prompt delivery on priority orders.

TOOL ENGINEERING SERVICE COMPANY, INC.
245 Washington Ave. Nutley, N. J.

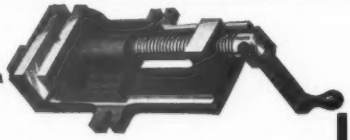
For Increased Production

use—SAFETY Wedge Grip LETTERS & FIGURES

- No Spalling.
- No Mushrooming.
- For Tough Stamping Jobs.
- Deeper Impressions.
- Knurled Sides Assures Positive Grip.
- More Safety.
- Any Size Character 1/16" to 1".

Write for Prices and Literature.

M. E. CUNNINGHAM CO.
104 E. Carson St. Pittsburgh, Pa.



YOST DRILL PRESS VISE

This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.

Offered in two sizes.

Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
1D	3½	3½	12½
2D	5	5½	23

Do you need a vise of ANY type?

Write today for bulletins on the extensive Yost line

YOST MFG. COMPANY
1000 MAIN ST.
MEADVILLE, PENNSYLVANIA

Here's Your Helper on Wheels

PORTELVATOR

Portable Elevating Table

Load it with dies, tools, parts, work-in-process . . . a thousand jobs made easier and quicker with this "helper on wheels." Capacity up to 20 tons.

Dept. T-11

THE HAMILTON TOOL CO.
Ninth and Hanover Streets.
HAMILTON OHIO

Portman Machine Tool Co., 17 Beechwood Ave., Mt. Vernon, N. Y.
Savage Tool Co., Dept. TD., Savage, Minn.
Thompson Grinder Co., Springfield, O.

GRINDERS—Swing Lathe
Jefferson Machine Tool Co., 710 N.W. 4th St., Cincinnati, O.

GRINDERS—Universal
Norton Company, Worcester, Mass.

GRINDERS—Utility
M-B Products, 130 E. Larned St., Detroit, Mich.

GRINDER CENTERS
McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa.

GRINDER TOOLS
Norton Company, Worcester, Mass.

GRINDING MACHINES—Tap
Oliver Instrument Co., 1436 Maumee St., E., Adrian, Mich.

GRINDING & LAPPING—Precision
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.

GRINDING WHEELS
Bridgeport Safety Emery Wheel Co., 1301 W. Broad St., Bridgeport, Conn.
Carborundum Company, The, Niagara Falls, N. Y.
Martindale Electric Co., 1417 Hird Ave., Cleveland, O.
Norton Company, Worcester, Mass.

GUIDE PINS
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 4751 Hough Ave., Cleveland, O.

HAMMERS & MALLETS—Rawhide
Chicago Rawhide Mfg. Co., 1280 Elston Ave., Chicago, Ill.
Victory Safety Hammer Corp., East Orange, N. J.

HAND TAPPERS
Marburg Bros., Inc., 88-92 West St., New York, N. Y.

HARDNESS TESTERS
Shore Instrument & Mfg. Co., Inc., The, 9025 Van Wyck Ave., Jamaica, N. Y.

HOISTS
American MonoRail Co., 13131 Athens Ave., Cleveland, Ohio

HOLDERS—Tap
Procunier Safety Chuck Co., 12-14 S. Clinton St., Chicago, Ill.

HOLDERS—Tool
Acme Tool Company, 200 Church St., New York, N. Y.
Armstrong Bros. Tool Co., 340 N. Francisco Ave., Chicago, Ill.
Auto-Ordnance Corp., 342 W. Putnam Ave., Bridgeport, Conn.
Gairing Tool Co., Roosevelt Park Annex, Detroit, Mich.

HONING MACHINES—Horizontal
Enterprise Machine Parts Corp., 2731 Jerome Ave., Detroit, Mich.

INDICATORS
Lufkin Rule Co., Saginaw, Mich.

INDICATORS—Dial
Federal Products Corp., 1 Reservoir St., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

INDICATORS—Test
Koch Test Indicator, 28 Second Ave., Nyack, N. Y.
Starrett Co., L. S., Athol, Mass.

INDEXING DEVICES
Hardinge Brothers, Inc., Elmira, N. Y.
Hartford Special Machy. Co., 281 Homestead Ave., Hartford, Conn.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Zagar Tool, Inc., 23881 Lakeland Blvd., Cleveland, O.

INDUSTRIAL LIGHTING — Equipment
Vimco Mfg. Co., 117 Chenango St., Buffalo, N. Y.

INKING OSCILLOGRAPH
Brush Development Co., The, 3311 Perkins Ave., Cleveland, O.

JACKS—Machine
Enterprise Machine Parts Corp., 2731 Jerome Ave., Detroit, Mich.

JIG BORERS
DeVlieg Machine Co., 450 Fair Ave., Ferndale, Mich.
Marburg Bros., Inc., 88-92 West St., New York, N. Y.

JIG GRINDERS
Marburg Bros., Inc., 88-92 West St., New York, N. Y.

KEYS—Socket Screw
Holo-Krome Screw Corp., Hartford, Conn.

LAPS—Copper Head Expansion
Boyar-Schultz Corp., 2112-M Walnut St., Chicago, Ill.

LAPPING—Contract
Acme Industrial Co., 206 N. Laflin St., Chicago, Ill.
Ultra Lap Machine Co., 254 McDougall Ave., Detroit, Mich.

LAPPING COMPOUND
Carborundum Company, The, Niagara Falls, N. Y.

LAPPING MACHINES
Norton Company, Worcester, Mass.
Schraner & Co., A. P., 3338 Payne Ave., Cleveland, O.
Ultra Lap Machine Co., 254 McDougall Ave., Detroit, Mich.

LATHE CENTERS
McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa.

LATHE DOGS
Armstrong Bros. Tool Co., 340 N. Francisco Ave., Chicago, Ill.

LATHES—Buffing
Bridgeport Safety Emery Wheel Co., 1301 W. Broad St., Bridgeport, Conn.

LATHES—Magnetic Polishing
Lima Electric Motor Co., Lima, O.

LATHES—Precision Plain Type
Hardinge Brothers, Inc., Elmira, N. Y.

LATHES — Precision Screw Cutting Type
Hardinge Brothers, Inc., Elmira, N. Y.

LATHES—Speed
Schauer Machine Co., 2076 Reading Rd., Cincinnati, O.

LATHES—Toolroom
Atlas Press Co., 1012 N. Pitcher St., Kalamazoo, Mich.
Monarch Machine Tool Co., The, Sidney, O.
Sebastian Lathe Co., P. O. Box 1017E, Cincinnati, O.
Sheldon Machine Co., Inc., 4336 No. Knox Ave., Chicago, Ill.
South Bend Lathe Works, Dept. 802, South Bend, Ind.

LAYOUT DYE
Dayton-Rogers Mfg. Co., Minneapolis, Minn.
Dykem Co., 2201 No. 11 St., St. Louis, Mo.
Michigan Chrome and Chemical Co., 6350 E. Jefferson Ave., Detroit, Mich.
Tamms Silica Co., 228 N. LaSalle St., Chicago, Ill.

LEADER PINS
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Die Supply Co., 4751 Hough Ave., Cleveland, O.

LIFTING EQUIPMENT
Economy Engineering Co., 2659 W. Van Buren St., Chicago, Ill.

MACHINE VISES
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Producto Machine Co., The, 990 Housatonic Ave., Bridgeport, Conn.

MAGNI-FOCUSER
Huebsch, N. L., 81 Yale St., E. Williston, N. Y.
Edroy Products Co., Dept. 12, 480 Lexington Ave., New York, N. Y.

MARKING DEVICES
AcromarK Company, The, 5-15 Morrell St., Elizabeth, N. J.
Cunningham Co., M. E., 104 E. Carson St., Pittsburgh, Pa.

METAL DUPLICATING MACHINES
O'Neil-Irwin Mfg. Co., 315 8th Ave., So., Minneapolis, Minn.

MICROMETERS
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.
Scherr Co., Inc., George, 128-B Lafayette St., New York, N. Y.

MILLING CUTTERS
Gairing Tool Co., The, Roosevelt Park Annex, Detroit, Mich.
Martindale Electric Co., 1417 Hird Ave., Cleveland, O.
Putnam Tool Co., 2985 Charlevoix, Detroit, Mich.
Severance Tool Co., 1506 E. Genesee Ave., Saginaw, Mich.
Tomkins-Johnson Co., 630 N. Mechanic St., Jackson, Mich.

MILLING FIXTURES
Auto-Ordnance Corp., 342 W. Putnam Ave., Bridgeport, Conn.

MILLING MACHINES—Attachments
Ajax Engineering & Manufacturing Co., 14230 Birwood, Detroit, Mich.
Burke Machine Tool Co., 301 E. 16th St., Conneaut, O.
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Kearney & Trecker Products Corp., West Allis Station, Milwaukee, Wis.

MILLING MACHINES—Continuous
Sommer & Adams Co., The, 18511 Euclid Ave., Cleveland, O.

MILLING MACHINES—Horizontal
Burke Machine Tool Co., 301 E. 16th St., Conneaut, O.
Douglas Machy. Co., 150 Broadway, New York, N Y
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Lucas & Sons, Inc., J. L., Bridgeport, Conn.

IF ACCURACY--PLUS IS WANTED

GET SMITH *MASTER* SURFACE PLATES

Smith Surface Plates will give you the maximum freedom from distortion with a minimum of deflection. Original design insures ample rigidity and stiffness for accurate measuring. Smith Surface Plates are satisfactorily meeting the tests of the country's leading precision toolmakers. You'll want detailed information and descriptive literature. Sent free on request.

Available Sizes

8″ x 12″
9″ x 14″
12″ x 18″
18″ x 24″
18″ x 18″
20″ x 30″
24″ x 24″
24″ x 36″
30″ x 36″
30″ x 60″
36″ x 68″

Other sizes made on order.

SMITH TOOL & ENGINEERING CO.
(Formerly Smith Tool Works, Inc.)
840 N. Sandusky Ave. Bucyrus, Ohio

AMC DEMAGNETIZER
A Tool Room Necessity

Every tool room needs this simple, portable, sturdy demagnetizer. Small parts passed through the powerful AMC field are instantly demagnetized. Large, flat surfaces can be demagnetized by sliding the device over the surface.

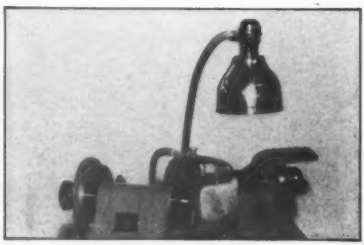
Price is only $32.50, complete as shown.

Write for full information.

ALOFS MFG. CO.
1619 Madison Ave., S. E., Grand Rapids, Mich.

EASY TO READ IN ANY POSITION. TWO READING FACES

LUFKIN
SAGINAW, MICHIGAN • New York City



MAXIMUM LIGHTING EFFICIENCY . . .

when you combine Vimcolight directly on the work with fluorescent lighting overhead. Makes work safer . . . lessens eye fatigue . . . reduces spoilage. Hundreds of America's finest machine tools are VIMCOLIGHTed. Are yours?

VIMCOLIGHT
VIMCO MANUFACTURING CO.
117 CHENANGO ST. BUFFALO, N. Y.

Machinery Manufacturing Co., 1915 E. 51 St., Vernon, Los Angeles, Cal.
Van Norman Machine Tool Co., Springfield, Mass.

MILLING MACHINES—Precision
Blank & Buxton Machine Co., 3110 E. Michigan Ave., Jackson, Mich.
Burke Machine Tool Co., 301 E. 16th St., Conneaut, O.
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Simmons Machine Tool Corp., 1760 N. Broadway, Albany, N. Y.

MILLING MACHINES — Precision Horizontal Floor Types
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Kempsmith Machine Co., Milwaukee, Wis.

MILLING MACHINES—Vertical
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
Jackson Machine & Tool Co., 956 Roberts St., Jackson, Mich.
Jefferson Machine Tool Co., 710 N.W. Fourth St., Cincinnati, O.
Kearney & Trecker Corp., West Allis Station, Milwaukee, Wis.
Linley Brothers, 14 Montauk, Bridgeport, Conn.
Machinery Manufacturing Co., 1915 E. 51 St., Vernon, Los Angeles, Cal.
Marburg Bros., Inc., 88-92 West St., New York, N. Y.
Sommer & Adams Co., The, 18511 Euclid Ave., Cleveland, O.

NUMBERING DEVICES
AcromarK Company, The, 5-15 Morrell St., Elizabeth, N. J.

OVENS—Industrial
Despatch Oven Co., 600 S.E. Ninth St., Minneapolis, Minn.
Johnson Gas Appliance Co., 560 E Ave., N.W., Cedar Rapids, Ia.

PLATES—Bench, Lapping, Surface
Busch Company, J. C., 172 S. Ferry St., Milwaukee, Wis.
Challenge Machinery Co., Grand Haven, Mich.
Delta Mfg. Co., 612-M East Vienna Ave., Milwaukee, Wis.
Tool Engineering Service Co., Inc., 245 Washington Ave., Nutley, N. J.

PLUGS—Hollow Pipe
Holo-Krome Screw Corp., Hartford, Conn.

POLISHING & BUFFING MACHINES—Automatic Continuous
Sommer & Adams Co., The, 18511 Euclid Ave., Cleveland, O.

POLISHING GRAIN
Carborundum Co., Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

PRESSES—Arbor
Atlas Press Co., 1012 N. Pitcher St., Kalamazoo, Mich.

PRESSES—Drill
Delta Mfg. Co., 612-M East Vienna Ave., Milwaukee, Wis.
Duro Metal Products Co., Dept. TP-21, 2640 N. Kildare Ave., Chicago, Ill.

PRESSES—Electric
Lempco Products, Inc., Dept. TD, Bedford, O.

PRESSES—Hand Punch
Leslie Welding Co., 2941 Carroll Ave., Chicago, Ill.

PRESSES—Utility
Producto Machine Co., The, 990 Housatonic Ave., Bridgeport, Conn.

PRODUCTION MACHINE REPAIR PARTS
Enterprise Machine Parts Corp., 2731 Jerome Ave., Detroit, Mich.

PULL FEEDS—Adjustable
Jefferson Machine Tool Co., 710 N.W. 4th St., Cincinnati, O.

PUMPS—Coolant
Ruthman Machinery Co., 1813 Reading Rd., Cincinnati, O.

PUMPS—Hydraulic
Racine Tool and Machine Co., 1768 State St., Racine, Wis.

PUNCH PRESS
Di Machine Corp., 3653 Lincoln Ave., Chicago, Ill.

PUNCHES—Hand, Toggle Action
Knu-Vise, Incorporated, 1332 Plum St., Detroit, Mich.

PUNCHES—Standard & Interchangeable
Hovis Screwlock Co., 8100 E. Nine Mile Road, Van Dyke, Mich.

PUNCHING & NOTCHING EQUIPMENT
Strippit Corporation, The, Buffalo, N. Y.
Whistler & Sons, Inc., S. B., 752-756 Military Rd., Buffalo, N. Y.

RACKS—Bar Stocks
Yohe Supply Co., Wm. S., 507 Gibbs Ave., N. E., Canton, O.

REAMERS
Putnam Tool Co., 2985 Charlevoix Ave., Detroit, Mich.

REAMERS—Flexible
Evans Flexible Reamer Co., 4543 Ravenswood Ave., Chicago, Ill.

REAMERS—Self-centering Cylinder
Royal Oak Tool & Machine Co., 621 E. Fourth Street, Detroit, Mich.

REAMING BARS
State Mfg. & Construction Co., Franklin, O.

RECTIFERS
Electro-Matic Products Corp., 2235 No. Knox Ave., Chicago, Ill.

RETAINERS—Punch & Die
Hovis Screwlock Co., 8100 E. Nine Mile Road, Van Dyke, Mich.

RIVETING MACHINES—Hydraulic
Tomkins-Johnson Company, The, 630 N. Mechanic St., Jackson, Mich.

ROLL FEEDS—Automatic
Wittek Mfg. Co., 4305-15 W. 24th Place, Chicago, Ill.

RUBBER ABRASIVES
Roberts Rubber Co., Weldon, Brightboy Industrial Div., Newark, N. J.

SANDERS—Belt
Duro Metal Products Co., Dept. TP-21, 2649 N. Kildare Ave., Chicago, Ill.
Jefferson Machine Tool Co., 710 N.W. 4th St., Cincinnati, O.
Walls Sales Corp., 97 Warren St. New York, N. Y.

SANDING RIDDLES — Gyrating Foundry
Jefferson Machine Tool Co., 710 N.W. 4th St., Cincinnati, O.

SAW BANDS
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
DoAll Co., Inc., 1203 Thacker St., Des Plaines, Ill.
Duro Metal Products Co., Dept. TP-21, 2649 N. Kildare Ave., Chicago, Ill.

SAW GRINDING FIXTURE
Industrial Eng. Co., Inc., 141 W. Jackson Blvd., Chicago, Ill.

SAWING MACHINERY
Tannewitz Works, The, Grand Rapids, Mich.

SAWING MACHINES—Continuous
Continental Machines, Inc., 1303 So. Washington St., Minneapolis, Minn.

SAWING MACHINES—Metal
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Peerless Machine Co., Dept. TDJ-1142, Racine, Wis.
Racine Tool & Machine Co., 1768 State St., Racine, Wis.

SAWS—Portable
Skilsaw, Inc., 5061 Elston Ave., Chicago, Ill.

SAWS—Hydraulic
Peerless Machine Co., Dept. TDJ-1142, Racine, Wis.
Racine Tool & Machine Co., 1768 State St., Racine, Wis.

SAWS—Swiss Piercing
Bollag, Max, 77 Wall St., New York, N. Y.

SCREW MACHINE PRODUCTS—Contract
Star Machine & Tool Co., 9320 Woodland Ave., Cleveland, O.

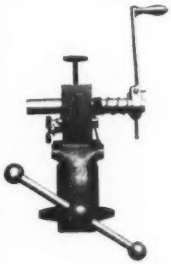
SCREW MACHINE PRODUCTS—Hardened & Ground
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.

SCREW MACHINES—Precision Bench Type
Hardinge Brothers, Inc., Elmira, N. Y.

SCREWS—Socket Head
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Detroit Die Set Corp., 2895 W. Grand Blvd., Detroit, Mich.
Die Supply Co., 4751 Hough Ave., Cleveland, O.
Holo-Krome Screw Corp., Hartford, Conn.
Manufacturers Supply Co., 2640 Carnegie Ave., Cleveland, O.
Standard Pressed Steel Co., Box 400, Jenkintown, Pa.
Strong, Carlisle & Hammond Co., 1392 West Third St., Cleveland, O.

SCRIBERS
Starrett Co., L. S., Athol, Mass.

SHAPERS
Atlas Press Co., 1012 N. Pitcher St., Kalamazoo, Mich.
Machinery Manufacturing Co., 1915 E. 51 St., Vernon, Los Angeles, Cal.
Morey Machinery Co., Inc., 410 Broome St., New York, N. Y.



Save
TIME
and
MONEY
with the
"BLANER"

Universal Hand SPRING WINDER

Every shop and tool room needs it . . . a strong, dependable unit . . . quickly set up in any vise.

Increases production of hundreds of sizes of springs.

Write for illustrated folder, giving complete details

THE JOHN BLANER COMPANY
Sharon ∴ Pennsylvania

PUNCH & DIE-FILER

No more hand filing of intricate jobs or inaccessible parts! With this universal machine you can take care of all filing and lapping jobs as they come along. Stroke fully adjustable from 0 to 1⅛". Two Speeds. Fully enclosed motor. Ball Bearings throughout. No dripping of oil. No waste of unused file sections.

Write for Descriptive Circular

MARBURG BROS., INC.
90 WEST ST., NEW YORK, N. Y.

from simplest

DIES

to most exacting

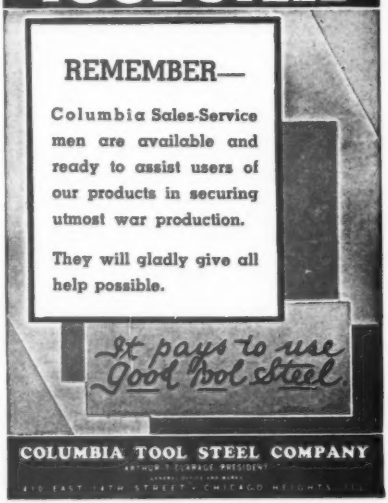
•

GAUGES — TOOLS — FIXTURES
JIGS — SPECIAL MACHINES
DESIGNING & ENGINEERING
HIGH PRODUCTION STAMPING

•

BARTH STAMPING & MACHINE WORKS
Die & Tool Makers
W. 34th & Denison Cleveland, O.

Columbia TOOL STEEL


REMEMBER—
Columbia Sales-Service men are available and ready to assist users of our products in securing utmost war production.
They will gladly give all help possible.
It pays to use Good Tool Steel
COLUMBIA TOOL STEEL COMPANY

SHARPENING STONES
Carborundum Co., Niagara Falls, N. Y.
Norton Company (Behr-Manning Div.), Worcester, Mass.

SHEARS—Bench
O'Neil-Irwin Mfg. Co., 315 8th Ave., So., Minneapolis, Minn.

SLOTTERS
Douglas Machinery Co., 150 Broadway, New York, N. Y.
Experimental Tool and Die Co., 12609 Greiner, Detroit, Mich.

SPACERS — For Milling Machine Arbors
Detroit Stamping Co., 344 Midland Ave., Detroit, Mich.

SPECIAL MACHINE—Designing
Enterprise Machine Parts Corp., 2731 Jerome Ave., Detroit, Mich.
Sommer & Adams Co., 18511 Euclid Ave., Cleveland, O.

SPOT FACERS
Bokum Tool Co., 14775 Wildemere Ave., Detroit, Mich.

SPRING WINDER
Blaner Co., John, The, Sharon, Pa.

SPRINGS
Detroit Die Set Corp., 2895 W. Grand Blvd., Detroit, Mich.
Gibson Co., The Wm. D., 1800 Clybourn Ave., Chicago, Ill. (Div. of Associated Spring Corp.)
Muehlhausen Spring Corporation, 875 Michigan Ave., Logansport, Ind.

SPRINGS—Die
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 4751 Hough Ave., Cleveland, O.
Muehlhausen Spring Corporation, 875 Michigan Ave., Logansport, Ind.

SPROCKETS—Roller and Block
Cullman Wheel Co., 1332 Altgeld St., Chicago, Ill.

SQUARES — Combination, Try and Mitre
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

STAMPINGS
Barth Stamping & Machine Works, W. 34th & Denison, Cleveland, O.
Davis Tool & Engineering Co., 19250 Plymouth Rd., Detroit, Mich.
Denning Mfg. Co., The, 1775-81 E. 87th St., Cleveland, O.
Detroit Stamping Co., 344 Midland Ave., Detroit, Mich.
Federal Tool Corp., 400 N. Leavitt St., Chicago, Ill.
Gibson Co., The Wm. D., 1800 Clybourn Ave., Chicago, Ill. (Div. of Associated Spring Corp.)
Star Machine & Tool Co., 9320 Woodland Ave., Cleveland, O.
Variety Machine & Stamping Co., The, 12695 Elmwood Ave., Cleveland, O.

STAMPS—Steel
AcromarK Company, The, 5-15 Morrell St., Elizabeth, N. J.

STEEL—Alloy
Allegheny-Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
Bissett Steel Co., 943 E. 67th St., Cleveland, O.
Columbia Tool Steel Co., 410 East 14th St., Chicago Heights, Ill.
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Forging and Casting Corp., Ferndale (Detroit), Mich.
Jessop Steel Co., 610 Green St., Washington, Pa.
Timken Roller Bearing Co., The, Steel and Tube Div., Canton, O.
Wheelock-Lovejoy & Co., Inc., 130 Sidney St., Cambridge, Mass.

STEEL—Carbon
Columbia Tool Steel Co., 410 East 14th St., Chicago Heights, Ill.
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Jessop Steel Co., 610 Green St., Washington, Pa.

STEEL—Chromium
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.

STEEL—"Cobalt"
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.

STEEL—Composite Die Section
Forging and Casting Corp., The, Ferndale, Mich.

STEEL—Graphitic
Timken Roller Bearing Co., The, Steel and Tube Div., Canton, O.

STEEL—High Speed
Ajax Steel & Forge Co., 205 Adair St., Detroit, Mich.
Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh, Pa.
Columbia Tool Steel Co., 410 East 14th St., Chicago Heights, Ill.
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Forging and Casting Corp., Ferndale (Detroit), Mich.
Jessop Steel Co., 610 Green St., Washington, Pa.

STEEL—Hobbing
Firth-Sterling Steel Co., McKeesport Pa.
Jessop Steel Co., 610 Green St., Washington, Pa.

STEEL—Tool & Die
Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh, Pa.
Columbia Tool Steel Co., 410 E. 14th St., Chicago Heights, Ill.
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Forging and Casting Corp., Ferndale (Detroit), Mich.
Jessop Steel Co., 610 Green St., Washington, Pa.
Peninsular Steel Co., The, 2224 Lakeside Ave., Cleveland, O.
Wheelock-Lovejoy & Co., Inc., 130 Sidney St., Cambridge, Mass.

STEEL PLATE—Ground
Die Supply Co., 4751 Hough Ave., Cleveland, O.

STEEL PLATE—Rough or Machined Torch Cut Shapes
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 4751 Hough Ave., Cleveland, O.

STEEL TREATING—Hardening
Lakeside Steel Improvement Co., 5418 Lakeside Ave., Cleveland, O.

SURFACE ANALYZER
Brush Development Co., The, 3311 Perkins Ave., Cleveland, O.

SURFACE PLATES
Busch Company, J. C., 172 S. Ferry St., Milwaukee, Wis.
Challenge Machinery Co., Grand Haven, Mich.
Delta Mfg. Co., 612-M East Vienna Ave., Milwaukee, Wis.
Smith Tool & Engrg. Co., 840 N. Sandusky Ave., Bucyrus, O.

SUTTONIZING
Welding Equipment & Supply Co., 226 Leib St., Detroit, Mich.

TABLES, ROTARY
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
Lafayette Tool & Supply Co., 176 Lafayette St., New York, N. Y.
Machinery Manufacturing Co., 1915 E. 51 St., Vernon, Los Angeles, Cal.

TAP EXTRACTOR
Walton Co., 88 Allyn St., Hartford, Conn.

TAP GRINDER
Boggis & Co., Henry P., 1277 W. Third St., Cleveland, O.

TAPPER—Precision
Brand Tool & Supply Co., 346 N. Vermont Ave., Los Angeles, Calif.
LaFayette Tool & Supply Co., 176 LaFayette St., New York, N. Y.
Marburg Bros., Inc., 88-92 West St., New York, N. Y.

TAPPING HEADS
Procunier Safety Chuck Co., 12-14 S. Clinton St., Chicago, Ill.

TAPPING MACHINES
Procunier Safety Chuck Co., 12-14 S. Clinton St., Chicago, Ill.

TAPS
Sossner Tool & Machine Works, Inc., 163 Grand St., New York, N. Y.

THREAD CHECKERS
American Gauge Co., The, 128 Bayard St., Dayton, O.

TOOL BITS
Tru-Cut Tool Co., 14236 Birwood, Detroit, Mich.

TOOLHOLDER—Universal
Acme Tool Co., 200 Church St., New York, N. Y.

TOOL SHANKS
Cooper-Bessemer Corp., Mt. Vernon, O.

TOOL STANDS
Scherr Co., Inc., George, 128-B Lafayette St., New York, N. Y.

TOOL STEEL—see STEEL—Tool and Die

TOOLS AND DIES—Carboloy
Kiffer Tool & Die Co., 5601 Tillman Ave., Cleveland, O.

TOOLS—Carbide Tipped
Ex-Cell-O Corporation, 1202 Oakman Blvd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa.

TOOLS—Diamond
Diamond Tool Co., 937 E. 41st St., Chicago, Ill.

Remove

BROKEN TAPS

Quickly
Insert WALTON Tap Extractor and back out broken piece. No annealing—no drilling.

Easily
Tap Extractor and Tap Wrench are only tools needed.

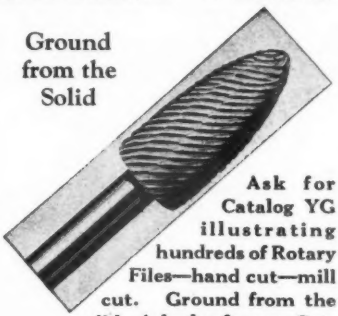
Safely
Threads are not damaged. Not necessary to tap oversize after broken tap is removed.

Write for Folder 151

THE WALTON COMPANY
88 Allyn Street Hartford, Connecticut

GROBET
ROTARY FILES

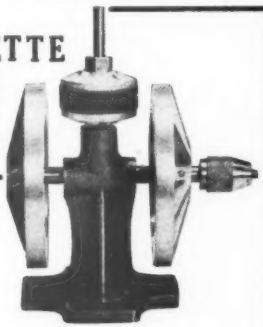
Ground from the Solid



Ask for Catalog YG illustrating hundreds of Rotary Files—hand cut—mill cut. Ground from the solid. Ask also for our Catalog YF illustrating more than 5000 different shapes, sizes and cuts of Grobet Precision Files, also files for all types of filing machines.

GROBET FILE COMPANY OF AMERICA
421 Canal Street New York City

LAFAYETTE FRICTION TAPPER



Clean and smooth in action. No gears to wear or break. Developed for the unskilled operator; saves intricate setup operations and costly jigs and fixtures. Can be operated from any drill press with ½" chuck or larger with continuous operation while press is running.

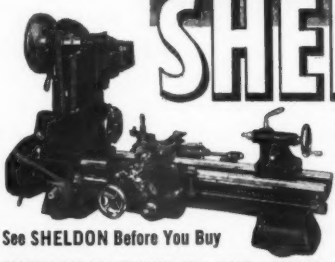
IMMEDIATE DELIVERY

Send for literature of our other products.

LAFAYETTE TOOL & SUPPLY CO.
178 Lafayette St., New York, N. Y.

SHELDON

BACK GEARED SCREW CUTTING PRECISION LATHES



See SHELDON Before You Buy

A complete line of full sized, full weight 10", 11" and 12" Precision Lathes . . . bench, floor and pedestal types built to industrial machine tool standards and specifications. Rigid, heavily braced, semi-steel beds with hand scraped ways —2 "V"-Ways and 2 Flat Ways. Each lathe has a full complement of attachments and accessories.

Just out—"The Care and Operation of a Lathe" to help apprentice training. 50¢ list price, discounts for quantity purchases.

SHELDON MACHINE CO., INC., 4236 No. Knox Ave., Chicago, U. S. A.

SHARPENING STONES
Carborundum Co., Niagara Falls, N. Y.
Norton Company (Behr-Manning Div.), Worcester, Mass.

SHEARS—Bench
O'Neil-Irwin Mfg. Co., 315 8th Ave., So., Minneapolis, Minn.

SLOTTERS
Douglas Machinery Co., 150 Broadway, New York, N. Y.
Experimental Tool and Die Co., 12609 Greiner, Detroit, Mich.

SPACERS — For Milling Machine Arbors
Detroit Stamping Co., 344 Midland Ave., Detroit, Mich.

SPECIAL MACHINE—Designing
Enterprise Machine Parts Corp., 2731 Jerome Ave., Detroit, Mich.
Sommer & Adams Co., 18511 Euclid Ave., Cleveland, O.

SPOT FACERS
Bokum Tool Co., 14775 Wildemere Ave., Detroit, Mich.

SPRING WINDER
Blaner Co., John, The, Sharon, Pa.

SPRINGS
Detroit Die Set Corp., 2895 W. Grand Blvd., Detroit, Mich.
Gibson Co., The Wm. D., 1800 Clybourn Ave., Chicago, Ill. (Div. of Associated Spring Corp.)
Muehlhausen Spring Corporation, 875 Michigan Ave., Logansport, Ind.

SPRINGS—Die
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 4751 Hough Ave., Cleveland, O.
Muehlhausen Spring Corporation, 875 Michigan Ave., Logansport, Ind.

SPROCKETS—Roller and Block
Cullman Wheel Co., 1332 Altgeld St., Chicago, Ill.

SQUARES — Combination, Try and Mitre
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

STAMPINGS
Barth Stamping & Machine Works, W. 34th & Denison, Cleveland, O.
Davis Tool & Engineering Co., 19250 Plymouth Rd., Detroit, Mich.
Denning Mfg. Co., The, 1775-81 E. 87th St., Cleveland, O.
Detroit Stamping Co., 344 Midland Ave., Detroit, Mich.
Federal Tool Corp., 400 N. Leavitt St., Chicago, Ill.
Gibson Co., The Wm. D., 1800 Clybourn Ave., Chicago, Ill. (Div. of Associated Spring Corp.)
Star Machine & Tool Co., 9320 Woodland Ave., Cleveland, O.
Variety Machine & Stamping Co., The, 12695 Elmwood Ave., Cleveland, O.

STAMPS—Steel
AcromarK Company, The, 5-15 Morrell St., Elizabeth, N. J.

STEEL—Alloy
Allegheny-Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
Bissett Steel Co., 943 E. 67th St., Cleveland, O.
Columbia Tool Steel Co., 410 East 14th St., Chicago Heights, Ill.
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Forging and Casting Corp., Ferndale (Detroit), Mich.
Jessop Steel Co., 610 Green St., Washington, Pa.
Timken Roller Bearing Co., The, Steel and Tube Div., Canton, O.
Wheelock-Lovejoy & Co., Inc., 130 Sidney St., Cambridge, Mass.

STEEL—Carbon
Columbia Tool Steel Co., 410 East 14th St., Chicago Heights, Ill.
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Jessop Steel Co., 610 Green St., Washington, Pa.

STEEL—Chromium
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.

STEEL—"Cobalt"
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.

STEEL—Composite Die Section
Forging and Casting Corp., The, Ferndale, Mich.

STEEL—Graphitic
Timken Roller Bearing Co., The, Steel and Tube Div., Canton, O.

STEEL—High Speed
Ajax Steel & Forge Co., 205 Adair St., Detroit, Mich.
Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh, Pa.
Columbia Tool Steel Co., 410 East 14th St., Chicago Heights, Ill.
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Forging and Casting Corp., Ferndale (Detroit), Mich.
Jessop Steel Co., 610 Green St., Washington, Pa.

STEEL—Hobbing
Firth-Sterling Steel Co., McKeesport Pa.
Jessop Steel Co., 610 Green St., Washington, Pa.

STEEL—Tool & Die
Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh, Pa.
Columbia Tool Steel Co., 410 E. 14th St., Chicago Heights, Ill.
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Forging and Casting Corp., Ferndale (Detroit), Mich.
Jessop Steel Co., 610 Green St., Washington, Pa.
Peninsular Steel Co., The, 2224 Lakeside Ave., Cleveland, O.
Wheelock-Lovejoy & Co., Inc., 130 Sidney St., Cambridge, Mass.

STEEL PLATE—Ground
Die Supply Co., 4751 Hough Ave., Cleveland, O.

STEEL PLATE—Rough or Machined Torch Cut Shapes
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 4751 Hough Ave., Cleveland, O.

STEEL TREATING—Hardening
Lakeside Steel Improvement Co., 5418 Lakeside Ave., Cleveland, O.

SURFACE ANALYZER
Brush Development Co., The, 3311 Perkins Ave., Cleveland, O.

SURFACE PLATES
Busch Company, J. C., 172 S. Ferry St., Milwaukee, Wis.
Challenge Machinery Co., Grand Haven, Mich.
Delta Mfg. Co., 612-M East Vienna Ave., Milwaukee, Wis.
Smith Tool & Engrg. Co., 840 N. Sandusky Ave., Bucyrus, O.

SUTTONIZING
Welding Equipment & Supply Co., 226 Leib St., Detroit, Mich.

TABLES, ROTARY
Gorton Machine Co., George, 1319 Racine St., Racine, Wis.
Lafayette Tool & Supply Co., 176 Lafayette St., New York, N. Y.
Machinery Manufacturing Co., 1915 E. 51 St., Vernon, Los Angeles, Cal.

TAP EXTRACTOR
Walton Co., 88 Allyn St., Hartford, Conn.

TAP GRINDER
Boggis & Co., Henry P., 1277 W. Third St., Cleveland, O.

TAPPER—Precision
Brand Tool & Supply Co., 346 N. Vermont Ave., Los Angeles, Calif.
LaFayette Tool & Supply Co., 176 LaFayette St., New York, N. Y.
Marburg Bros., Inc., 88-92 West St., New York, N. Y.

TAPPING HEADS
Procunier Safety Chuck Co., 12-14 S. Clinton St., Chicago, Ill.

TAPPING MACHINES
Procunier Safety Chuck Co., 12-14 S. Clinton St., Chicago, Ill.

TAPS
Sossner Tool & Machine Works, Inc., 163 Grand St., New York, N. Y.

THREAD CHECKERS
American Gauge Co., The, 128 Bayard St., Dayton, O.

TOOL BITS
Tru-Cut Tool Co., 14236 Birwood, Detroit, Mich.

TOOLHOLDER—Universal
Acme Tool Co., 200 Church St., New York, N. Y.

TOOL SHANKS
Cooper-Bessemer Corp., Mt. Vernon, O.

TOOL STANDS
Scherr Co., Inc., George, 128-B Lafayette St., New York, N. Y.

TOOL STEEL—see STEEL—Tool and Die

TOOLS AND DIES—Carboloy
Kiffer Tool & Die Co., 5601 Tillman Ave., Cleveland, O.

TOOLS—Carbide Tipped
Ex-Cell-O Corporation, 1202 Oakman Blvd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa.

TOOLS—Diamond
Diamond Tool Co., 937 E. 41st St., Chicago, Ill.

Remove
BROKEN TAPS

Quickly
Insert WALTON Tap Extractor and back out broken piece. No annealing—no drilling.

Easily
Tap Extractor and Tap Wrench are only tools needed.

Safely
Threads are not damaged. Not necessary to tap oversize after broken tap is removed.

Write for Folder 151

THE WALTON COMPANY
88 Allyn Street Hartford, Connecticut

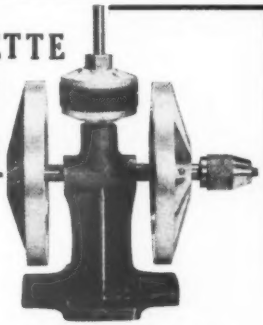
GROBET
ROTARY FILES

Ground from the Solid

Ask for Catalog YG illustrating hundreds of Rotary Files—hand cut—mill cut. Ground from the solid. Ask also for our Catalog YF illustrating more than 5000 different shapes, sizes and cuts of Grobet Precision Files, also files for all types of filing machines.

GROBET FILE COMPANY OF AMERICA
421 Canal Street New York City

LAFAYETTE FRICTION TAPPER



Clean and smooth in action. No gears to wear or break. Developed for the unskilled operator; saves intricate setup operations and costly jigs and fixtures. Can be operated from any drill press with ½" chuck or larger with continuous operation while press is running.

IMMEDIATE DELIVERY

Send for literature of our other products.

LAFAYETTE TOOL & SUPPLY CO.
178 Lafayette St., New York, N. Y.

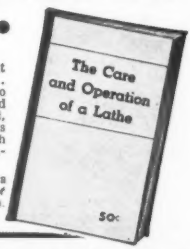
SHELDON

BACK GEARED SCREW CUTTING PRECISION LATHES

See SHELDON Before You Buy

A complete line of full sized, full weight 10", 11" and 12" Precision Lathes . . . bench, floor and pedestal types built to industrial machine tool standards and specifications. Rigid, heavily braced, semi-steel beds with hand scraped ways —2 "V"-Ways and 2 Flat Ways. Each lathe has a full complement of attachments and accessories.

Just out—"The Care and Operation of a Lathe" to help apprentice training. 50¢ list price, discounts for quantity purchases.



SHELDON MACHINE CO., INC., 4236 No. Knox Ave., Chicago, U. S. A.

Lacey

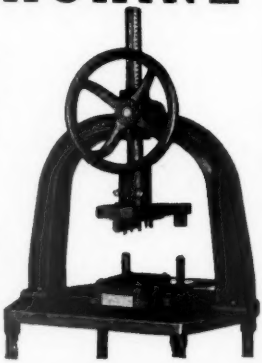
DIE-SET MACHINE

- POSITIVE, SENSITIVE ALIGNMENT at all times.
- EASY TO OPERATE with one hand.
- FULL VISION and CONTROL over job.

NO pry-bars or hammers necessary in separating punches from dies when you use this Lacey Die-Set Machine. Easy to operate, it aligns punches to dies quickly and efficiently. The large handwheel which provides for sensitive, accurate lining up makes it possible for the tool maker to shear-in certain types of dies.

Equipped with safety stop for any position of ram, this machine cuts down toolroom time and costs in tooling up, and improves die making and the finished product.

PROMPT DELIVERY



MARBURG BROTHERS, INC., 88-92 West St., NEW YORK

TOOLS—Filing and Honing
Acme Tool Co., 202 Church St., New York, N. Y.

TOOLS—Flexible Shaft
Foredom Electric Co., 27 Park Pl., New York, N. Y.

TOOLS—Precision, Diemakers
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

TOOLS—Sintered Carbide
Firth-Sterling Steel Co., McKeesport Pa.

TORCHES—Hand Gas
Johnson Gas Appliance Company, 56C E Avenue, N.W., Cedar Rapids, Ia.

TUBING—Tool Steel
Bissett Steel Co., The, 943 E. 67th St., Cleveland, O.

TURRETS FOR TAIL-STOCK SPINDLE
Jefferson Machine Tool Co., 710 N.W. 4th St., Cincinnati, O.

TURRETS FOR TOOL-POST CARRIAGE
Jefferson Machine Tool Co., 710 N.W. 4th St., Cincinnati, O.

TYPE HOLDER
Acromark Company, The, 5-15 Morrell St., Elizabeth, N. J.

V-BLOCKS
Oliver Motorcraft Corp., 2536 S. Wabash Ave., Chicago, Ill.

VISES—Air
Brown Corp., W. R., 5720 Armitage Ave., Chicago, Ill.

VISES—Drill Press
Yost Mfg. Co., 1000 Main St., Meadville, Pa.
Richards Co., J. A., 900 N. Pitcher St., Kalamazoo, Mich.

VISES—Machine
Jefferson Machine Tool Co., 710 N.W. 4th St., Cincinnati, O.
Producto Machine Co., The, 990 Housatonic Ave., Bridgeport, Conn.
Ross Company, David J., Benton Harbor, Mich.

WELDING
Danly Machine Specialties, Inc., 2100 So. 52nd Ave., Chicago, Ill.

WELDING PLIERS
Knu-Vise, Incorporated, 16877 Hamilton Ave., Detroit, Mich.

WELDING POSITIONERS
Cullen-Friestedt Co., 1316 S. Kilbourn Ave., Chicago, Ill.

WELDING RODS
Darwin & Milner, Inc., 1260-1264 West Fourth St., Cleveland, O.
Welding Equipment & Supply Co., 226 Leib St., Detroit, Mich.

WHEELS—Mounted
Chicago Wheel and Mfg. Co., 1101 W. Monroe St., Dept. TD, Chicago, Ill.

WIRE FORMS AND SHAPES
Gibson Co., The Wm. D., 1800 Clybourn Ave., Chicago, Ill. (Div. of Associated Spring Corp.)

Inspectograph - Price, $35

BETTER INSPECTION PROPER MAGNIFICATION

with

SHADOWLESS FLUORESCENT
ILLUMINATION

for

INSPECTORS
TOOLMAKERS
MACHINISTS

S. Lowe & Sons Co. 100 Sanford St. Fairfield, Conn.

WRITE FOR CIRCULAR

OUR NEW PLANT

Now in operation, devoted exclusively to the manufacture of precision gages:

PLUG . . . SNAP . . . FLUSH PIN . . . and BUILT-UP GAGES

May we have the opportunity to serve you?

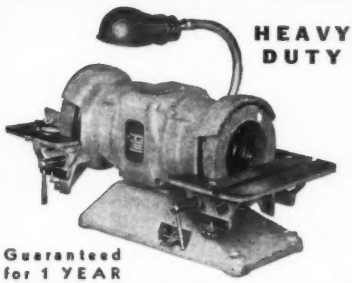
Lauer Tool and Gauge Company

14265 Birwood . . . . Detroit, Michigan

BALDOR

Special GRINDER for

CARBIDE TOOLS



HEAVY DUTY

Guaranteed for 1 YEAR

For accurately and quickly sharpening Carbide Tools, use the BALDOR special carbide tool grinder; ½ HP ball bearing reversible motor; adjustable tables and tool rests; 6" Silicon Carbide wheels. Price, complete as shown above. **$95.00**

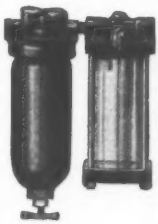
Ask for BULLETINS on COMPLETE LINE of BALDOR General Purpose Grinders, Buffers and Electric Motors

BALDOR ELECTRIC COMPANY
4305 Duncan Ave. ST. LOUIS, MO.

• M-B •

AIR-LINE FILTER and AUTOMATIC LUBRICATOR

Removes 96% to 97% of All Water, Dirt and Scale from Airline



Air passes through a series of brass discs with .002 spacings, providing the finest degree of filtration obtainable by any known method. Then, as the air passes through head of Lubricator, oil is delivered into the purified air line in any desired volume.

ALSO PORTABLE PNEUMATIC GRINDERS

Write for FREE TRIAL Offer

M-B PRODUCTS • EXPORT OFFICE 44 WHITEHALL ST. New York N.Y. U.S.A.
130 E. LARNED ST. DETROIT, MICH.

Micro Supreme IMPROVED **LAY-OUT DYE**

for SHARPLY DEFINED SCRIBED LINES

for TOOL, DIE, PATTERN, OR TEMPLATE LAYOUT ON METAL

LOW IN PRICE

One Qt. $1.50 One Gal. $4.25
Five Gals. $18.75

MICHIGAN CHROME & CHEMICAL COMPANY
6350 East Jefferson Avenue • • Detroit, Michigan

Modern facilities for designing and building Precision Tools—Dies—Jigs—Fixtures—Molds—Gages—Special Machines—Precision Specialties. Also, shops equipped to provide Stampings—Forgings—Castings—Plastics—Grinding—and similar contract services.

Hartford, Connecticut

*HARTFORD SPECIAL MACHY. CO.
281 Homestead Avenue
SPECIAL MACHINES
Gears—Cams—Precision Specialties

Belleville, Illinois

DRESEL-BETZ COMPANY
Belleville, Ill.
Designers and Manufacturers of
Tools, Dies, Jigs, Fixtures, Metal Stampings

Chicago, Illinois

PRESS BRAKE DIES

AND PUNCHING
ATTACHMENTS for ALL
MAKES of PRESS BRAKES

DREIS & KRUMP MFG. CO.
7428 S. Loomis Blvd. Chicago, Ill.

*FEDERAL TOOL CORPORATION
400 North Leavitt St. HAYmarket 2150
Tools Dies Jigs Fixtures
Stampings Special Machinery

Detroit, Michigan

A. M. TOOL & DIE WORKS
14115 Woodrow Wilson Ave.
TOwnsend 8-0677
Tools - Dies - Jigs - Fixtures
Special Machinery
NEW EQUIPMENT GOOD DELIVERIES

ACE TOOL & DIE COMPANY
3801 Trenton Ave. ORegon 1008
TOOLS and DIES
Special Machinery

***See larger display advertisement also.**

Detroit—[Cont'd]

DAVIS TOOL & ENGINEERING COMPANY
19250 Plymouth Rd. VErmont 5-6000
Tools and Dies Special Machinery
Sheet Metal Stampings and Assemblies

*ENTERPRISE MACHINE PARTS CORP.
2731 Jerome Avenue TWinbrooke 1-7900
EMPCO Drilling, Milling and Tapping Units
EMPCO Machine Levelling Jacks
Production Machine Repair Parts, Tools and Fixtures
Single Purpose Machine Specialists

*MAJESTIC TOOL & MFG. COMPANY
2946 Woodbridge St., East FItzroy 1011
Manufacturers
General line of Tool and Die Work, Tool Details, Parker High Speed Grinding Spindles

ROBBINS ENGINEERING COMPANY
318 Midland Ave. FItzroy 4740
Designers and Manufacturers
Tools, Dies, Jigs, Fixtures
Special Machinery and Experimental Work

ROYAL OAK TOOL & MACHINE CO.
621 E. Fourth St., Royal Oak, Mich. ELmhurst 6580
Manufacturers of
Tools, Dies, Jigs, Fixtures. Special Machinery and Designing. Hoch Self-Centering Cylinder Reamers

Muskegon, Michigan

TOOL DESIGNING
PROCESS ENGINEERING
MACHINE DEVELOPMENT
AGERSTRAND CORPORATION
Engineering Division
Muskegon, Michigan
Detroit Office—1900 E. Jefferson Ave.
Phone: Fitzroy 2575

Belleville, New Jersey

THE VIKING TOOL & MACH. CORP.
6 Main St. Belleville, N. J.
Tools—Dies—Jigs—Fixtures—Molds—Gages
Machines—Stampings—Specialties

Jamestown, New York

RANE TOOL CO., Inc.
17 Ross St. Phone 5934
Specialists In
Blanking, Forming and Drawing Dies

New York, New York

BRAUN & MURN
118 E. 28th St. New York, N. Y.
Tools, Dies, Jigs, Gages, etc.
Please send blueprints for quotation

CONRAD & MOSER
2-23 Borden Ave. Long Island City, N. Y.
Machine Tools & Molds, Parts & Machines
Aluminum Cast Parts—Aluminum Sheet
Formed Housings

Cleveland, Ohio

*BARTH STAMPING & MACHINE WORKS
Die & Tool Makers
W. 34 & Denison Fl. 8411

*THE BUNELL MACHINE & TOOL CO.
1620 East 24th St. CHerry 0343
DIES—JIGS—FIXTURES
Gages—Models
SPECIAL MACHINERY
Swiss Jig Boring
Screw Machine Products
Complete Engineering Facilities

CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave. MUlberry 2600
Designers and Builders
Jigs & Fixtures Special Machines
Production Engineering
COMPLETE PLANT ROUTING and TOOLING

THE DENNING MANUFACTURING COMPANY
1775-81 East 87th St. CEdar 0801
Designers and Builders
HIGH GRADE DIES

GENERAL DIE & TOOL COMPANY
2067 W. 55th St. WOodbine 4736
Dies Tools Jigs Fixtures
Light Stampings Manufacturing Special Machinery

THE INDUSTRIAL MACHINE CO.
1436 East 47th Street Founded in 1903
Builders of Special Machinery
GENERAL MACHINE WORK

KIFFER TOOL & DIE CO.
5601 Tillman Ave. WOodbine 2440-2441
Manufacturers Special Machinery
Tools, Dies, Jigs, Fixtures, Tungsten Carbide Tools
SWISS JIG BORING

*See larger display advertisement also.

THE LORAIN MACHINE & TOOL CO.
1951 West 90th St. MElrose 5010
Designers and Builders
Dies, Jigs, Fixtures, Gages
Special Machinery, Jig Boring

*THE McKINNEY TOOL & MANUFACTURING CO.
1688 Arabella Rd. KEnmore 1681
Designers and Builders
Jigs—Fixtures, Dies, Special Machinery
Swiss Jig Boring General Machine Work

NOBLE & STANTON, Inc.
998 Broadway Bedford, Ohio
Bedford 1234
Tool Makers
Specialists in Aircraft Work

*OHIO TOOL COMPANY
3160 West 106th St. ORchard 3200
Designers and Builders
SHEET METAL DIES, TOOLS, SPECIAL MACHINERY, DIE CASTING DIES
RUBBER MOULDS
●
Modern Facilities

PARAMOUNT TOOL CO.
1392-98 East 43rd St. ENdicott 2220
JIGS, FIXTURES, DIES
Experimental Work

The PHOENIX MACHINE COMPANY
2711 Church Ave. CHerry 1048
CONTRACT GRINDING
BORING and PLANING
LESTER-PHOENIX DIE CASTING AND PLASTIC MOLDING MACHINES

A. P. SCHRANER & COMPANY
3338 Payne Ave. HEnderson 8644
EXTERNAL CYLINDRICAL LAPPING MACHINES
Special Machinery
TOOLS, DIES, JIGS, FIXTURES

*THE SOMMER & ADAMS CO.
18511 Euclid Ave. KEnmore 0810-0811
DESIGNERS AND BUILDERS OF
Special Machinery
TOOLS JIGS FIXTURES
The Cleveland No. 1 Vertical Milling Machine

STAR MACHINE & TOOL COMPANY
9320 Woodland Ave. GArfield 2060
Designers and Builders
Dies, Jigs, Fixtures, Gages, Special Machinery
Jig Boring—Planer Equipment

THE KOCH TEST INDICATOR

— the only Tool Makers' Indicator on the market with Two Working Ends for inside and outside tests. Compression and balance torsion give accuracy to a tool of high magnifying power. Scale of indicator reads .001" and has 11 lines divided into 1/4" space. Shock proof. Attachments of the indicator broaden its use and fit any gauge on the market with 1/4" spindle. Dealers Wanted.

Send for Bulletin T.

THE KOCH TEST INDICATOR
28 2nd Ave. Nyack, N. Y

(Continued from Page 189)

Cleveland, Ohio

*TOOLS & GAGES, Inc.
3112 East 63rd St. MIchigan 7230
"Let us be your tool room."
DESIGNERS AND BUILDERS
Tools, Gages, Dies, Jigs, Fixtures
Special Machinery
Swiss Jig Boring - Die Casting Dies

THE VARIETY MACHINE & STAMPING COMPANY
12695 Elmwood Ave. LAkewood 8433
Designers and Manufacturers
Dies, Metal Stampings 250 tons capacity

Hamilton, Ohio

*THE HAMILTON TOOL COMPANY
Ninth and Hanover Streets
Designers and Builders of
Tools, Dies, Jigs, Fixtures, Special Machinery
The Hamilton Portable Elevating Table
*See larger display advertisement also.

Noted Inventor Dies

The death of Charles Hotchkiss Norton, 91, who had long been associated with Norton Co., Worcester, Mass., ended the career of an inventor whose genius is credited with having made one of the greatest contributions by an individual to American mass production methods. The importance of Norton production in this war was acknowledged early this year when the Army-Navy E for excellence in production was awarded the Norton Co.

SCHAUER IDEAL **Speed Lathes**

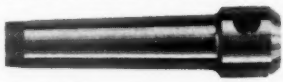
IDEAL for POLISHING LAPPING FINISHING of small parts.

Write For Catalog No. 420

"the originators of today's Speed Lathes"

SCHAUER MACHINE CO. 2076 Reading Road CINCINNATI, OHIO

HARDENED AND GROUND
END MILL HOLDERS



These Holders are available with straight ground holes for end mills with 1/4", 3/8", 1/2", 5/8" and 3/4" shanks.

Immediate Delivery

RUSNOK TOOL WORKS
4840 W. North Ave., Chicago

Be 100% with your

10%

Buy **WAR BONDS**

DID YOU GET YOUR SAMPLE OF

TAMMS BLUE LAYOUT DOPE?

Speeds layout on all metals. Gives clean accurate detail. Won't chip, crack or flake off. Comes 8 oz. brush-in cans, also pts., qts., gals., drums.

TAMMS SILICA CO., 228 N. LaSalle St., Chicago, Ill.

SWISS PIERCING SAWS

Just arrived — a shipment of brown Jeweler Saws, "MONTBLANC" extra strong, made in Switzerland, sizes No. 1 to No. 10. Superior, finely tempered, steel blades.
Order NOW while these fine saws are still available.
Samples on request

MAX BOLLAG 77 WALL STREET NEW YORK, N. Y.

LESLIE HAND PUNCH PRESS
MOST CAPACITY
POSITIVE ALIGNMENT

Max. cap. 2" dia. hole thru 10 ga. iron, proper shear on punch, throat depth 6". Takes punch press dies up to 3" x 4½" in area. Leaf arm gives perfect alignment without ways or leader pins. Portable.

Write for Catalog

Ask your dealer or write direct.

LESLIE WELDING CO.
2941 Carroll Ave. Chicago

THE PRECISION UNIVERSAL TOOL HEAD
brings all adjustments under absolute micrometric control without stopping tool or machine.
In Jig Borer, Milling Machine or Boring Mill, it bores, faces, counterbores, turns outside diameters, mills flat surfaces and slots, undercuts, recesses, back faces and does an almost limitless range of "headache" jobs. Send for bulletins.

Removal Notice:
We are no longer located at Bridgeport, Conn.
Send all communications, inquiries and orders to

THE PRECISION TOOL COMPANY
P. O. Box 155, Brooklyn, New York

SALESMEN WANTED

Throughout Country Calling on Tool-Room and Grinder Foremen to Carry a Side Line of Greatly Improved Diamond Point Wheel Dressers and Diamond Tools. Please Write: The TOOL & DIE Journal, Box No. C-11, 2460 Fairmount Blvd., Cleveland, O.

MARKING SPECIALISTS CAN SHOW YOU THE QUICK

WAY TO MARK OFFENSE PARTS WITH NUMBERING, LETTERING AND DESIGN.

MARKING MACHINES, NUMBERING MACHINES, STEEL LETTERS & FIGURES CARRIED IN STOCK OR MADE TO ORDER.

Send Your Marking Problem and Ask for Catalog.

The AcromarK Corporation
5-15 Morrell St. Elizabeth, N. J.

Precision Collets

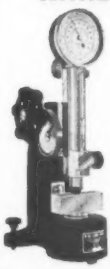
AND DRAWBARS TOO

Available now to fit ATLAS and LOGAN 10" Lathes ... Also Drawbars for 8" and 9" SOUTH BEND Lathes. Guaranteed for accuracy and long life.

Order through your dealer; if he cannot supply you write us giving his name. Catalog upon request.

PRECISION COLLET CO., 265 Canal St., N. Y. C.
Subsidiary of General Die & Stamping Corp., N.Y.C.

HARDNESS TESTING



has been done with the
SCLEROSCOPE
since 1907

•

THE SHORE INSTRUMENT & MFG. CO., INC.
9025 Van Wyck Avenue
Jamaica, N. Y.

Advertisers Index

A. M. Tool & Die Works 188
Ace Tool and Die Company 188
Acme Industrial Company 159
Acme Tool Company 161
AcromarK Corporation 191
Agerstrand Corporation 188
Ajax Engineering & Mfg. Co. 109
Ajax Steel & Forge Company 152
Allegheny Ludlum Steel Corporation 21
Alofs Manufacturing Company 181
American Broach & Machine Company 84
American Diamond Tool & Gauge Co. .....
American Gauge Co., The .....
American Industrial Publishers 122, 160
American MonoRail Company 14
American Photocopy Equipment Co. .....
Armstrong-Blum Mfg. Company 196
Armstrong Bros. Tool Company 177
Atlantic Machinery Corporation 142
Atlas Equipment Company 153
Atlas Press Company .....
Auto-Ordnance Corporation 23

Baker Bros, Inc. 168
Baldor Electric Company 187
Bartelt Engineering Company 152
Barth Stamping & Machine Works 183, 189
Berkeley Equipment Company 161
Bissett Steel Company 172
Black Drill Company 147
Blanchard Machine Company 41
Blaner Co., The John 183
Blank & Bluxton Machinery Company 13
Boggis & Co., Henry P. .....
Bokum Tool Company .....
Bollag, Max 191
Boyar-Schultz Corporation 36
Brand Tool & Supply Co. 170
Braun & Murn 189
Bridgeport Safety Emery Wheel Co. .....
Brown Corporation, W. R. 126
Brush Development Company 194
Bunell Machine & Tool Company 15, 189
Burke Machine Tool Company 172
Busch Company, J. C. 175

Carboloy Company, Inc. .....
Carborundum Company, The 93
Cerro de Pasco Copper Corporation .....
Challenge Machinery Company 165
Chicago Manufacturing & Distributing Company 8
Chicago Rawhide Mfg. Company 164
Chicago Wheel & Mfg. Company 116
Christensen Diamond Tool Company .....
Cleveland Tool Engineering Co., The 11
Cleveland Twist Drill Company 46
Cleveland Universal Jig Company 189
Colonial Bushings, Inc. 171
Columbia Tool Steel Company 183
Conrad & Moser 189
Continental Machines, Inc. .....
Cooley Electric Mfg. Company .....
Cooper-Bessemer Corp., The .....
Cullen-Friestedt Company 145

Cullman Wheel Company 162
Cunningham Co., M. E. 179

Danly Machine Specialties, Inc. 35
Darwin & Milner, Inc. .....
Davis Tool & Engineering Company 188
Dearborn Gage Company 39
Delta Manufacturing Company 113
Denning Manufacturing Company 189
Despatch Oven Company 103
Detroit Die Set Corporation 169
Detroit Stamping Company 44
DeVlieg Machine Company 12
Di Machine Corporation .....
Diamond Tool Company 172
Die Supply Company 136
DoAll Co., Inc., The 25
Douglas Machinery Company 124, 139, 151
Dreis and Krump Mfg. Company 188
Dresel-Betz Company 188
Dumore Company, The 42
Duro Metal Products Company 28
Dykem Company 175

Eastern Etching & Mfg. Company 123
Economy Engineering Company 43
Edroy Products Co. .....
Electro-Matic Products Co. 162
Empire Tool Company .....
Enterprise Machine Parts Corp. 9, 188
Evans Flexible Reamer Co. 175
Ex-Cell-O Corporation 96
Experimental Tool & Die Company 140

Federal Products Company .....
Federal Tool Corporation 168, 188
Firth-Sterling Steel Company 16, 17
Foley Manufacturing Company 169
Forging and Casting Corporation, The 2

Gairing Tool Company .....
Gallmeyer & Livingston Company 177
General Die & Tool Company 189
Gibson Co., William D. 134
Gilron Products Company 26
Golconda Diamond Products Corp. 143
Gorton Machine Company, George 115
Gray-Mills Company 30
Grobet File Company of America 185

Hamilton Tool Company 175, 179, 190
Hammond Machinery Builders, Inc. 141
Hardinge Bros, Inc. 3
Hartford Special Machinery Co. 171, 188
Holo-Krome Screw Corporation 5
Hopp Press Company 173
Hovis Screwlock Company 37

Ideal Commutator Dresser Company 157
Illinois Tool Works .....
Industrial Engineering Company 114
Industrial Machine Company, The 189

Jackson Machine & Tool Company 34
Jansson Gage Company 173
Jefferson Machine Tool Company 27

Jessop Steel Company 91
Johnson Gas Appliance Company .....

Kearney & Trecker Corp. 18, 19
Kelly Co., The O. S. .....
Kempsmith Machine Co. .....
Kiffer Tool & Die Company 189
Knu-Vise, Inc. .....
Koch Test Indicator, The 190
Koebel Diamond Tool Company .....
Kold Hold Mfg. Corp. .....
Kopec Engr. Co., S. J. .....

Lafayette Tool & Supply Company 185
Lakeside Steel Improvement Company 135
Lauer Tool & Gage Co. 189
Leach Machinery Company, H. 159
Lempco Products, Inc. 89
Leslie Welding Company 191
Lima Electric Motor Company, The 32
Linderme Machine and Tool Company 144
Linley Bros Company 92
Lorain Machine & Tool Company 189
Lowe & Sons Co., S. 186
Lucas & Son, Inc., J. L. 95
Lufkin Rule Company 181

M-B Products 187
Machinery Manufacturing Co. .....
Majestic Tool & Mfg. Co. 154, 188
Manufacturers Supply Company 148
Marburg Bros., Inc. 156, 171, 183, 186
Martindale Electric Company .....
McKenna Metals Company .....
McKinney Tool & Manufacturing Co. 111, 189
Mead Specialties, Inc. 173
Metal Carbides Corporation 155
Michigan Chrome and Chemical Co. 187
Michigan Industrial Sales, Inc. .....
Michigan Tool Company .....
Mills Novelty Company .....
Modern Motor Drives, Inc. .....
Monarch Machine Tool Company, The 106
Morey Machinery Company, Inc. 99
Muehlhausen Spring Corp. 97

Noble & Stanton, Inc. 189
Norton Company 90

Ohio Tool Company 6, 7, 189
Oliver Instrument Company 166
Oliver Motorcraft Corp. 177
O'Neil-Irwin Mfg. Company 154

Paramount Tool Company 189
Peerless Machine Company 10
Peninsular Steel Company, The .....
Perfex Gage & Tool Co. 40
Pheonix Machine Company 189
Portman Machine Tool Company 133
Precision Collet Company 191
Precision Tool Company, The 191
Procunier Safety Chuck Company 38
Producto Machine Company, The 156
Putnam Tool Company ..... Front Cover

Queen City Machine Tool Co. 112

Racine Tool and Machine Company 146
Rane Tool Company, Inc. 188
Revco, Inc. 137
Richards Co., J. A. .....
Rivett Lathe & Grinder, Inc. .....
Robbins Engineering Company 188
Roberts Rubber Co., Weldon 125
Ross Co., David J. 167
Royal Oak Tool & Machine Company 188
Rusnok Tool Works 190
Ruthman Machinery Co. 177

Savage Tool Company 101
Sav-Way Tool and Machining Co. 20
Schauer Machine Co. 190
Scherr Co., Inc., George 22
Schraner, A. P., & Company 189
Sebastian Lathe Co., The 98
Severance Tool Company .....
Sheldon Machine Company, Inc. 185
Shore Instrument & Mfg. Co., Inc. 191
Simmons Machine Tool Corp. .....
Skilsaw, Inc. .....
Smith Power Transmission Co. .....
Smith Tool & Engineering Co. 181
Sommer & Adams Co. 189, 195
Sossner Tool & Machine Works 31
South Bend Lathe Works 110
Standard Pressed Steel Company 165
Star Machine & Tool Company 189
Starrett Company, L. S. 149
State Mfg. & Construction Company 128
Strippit Corporation, Inc. 100
Strong, Carlisle & Hammond Co. .....

Tamms Silica Company 190
Tannewitz Works, The 102
Taylor Machine Co. 172
Template Products .....
Thompson Grinder Company 107
Timken Roller Bearing Company 33
Tomkins-Johnson Company 150
Tool Engineering Service Co., Inc. 179
Tools & Gages, Inc. 170, 190
Tru-Cut Tool Company 164
Tungsten Electric Corporation 108
Turner Gauge Grinding Company 105

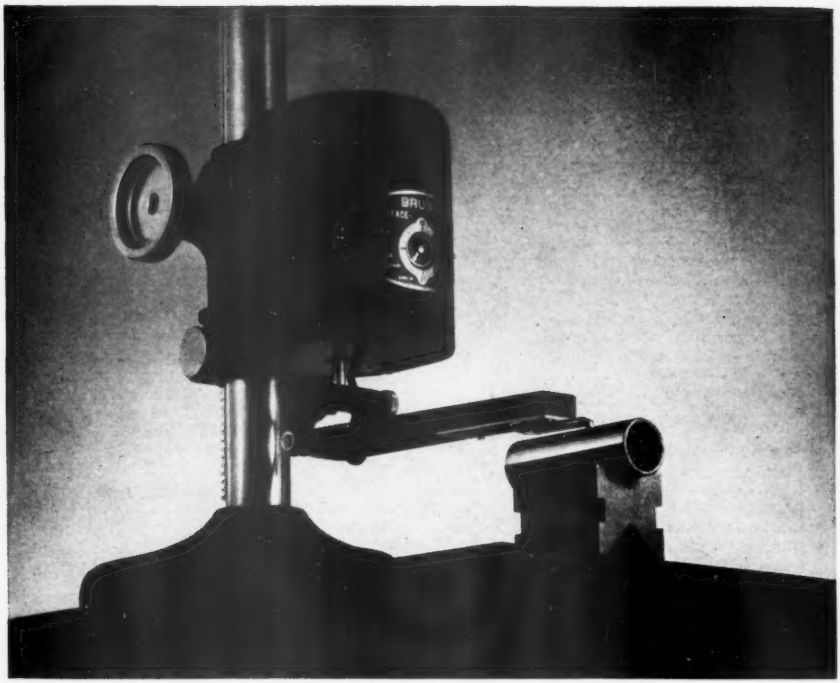
U. S. Machine Tool Manufacturing Corp. 171
Ultra Lap Machine Company 132
United Precision Products Company 127
United States Treasury 190
Universal Engineering Company 167

Van Norman Machine Tool Co. 24
Variety Machine & Stamping Company 190
Vickers Broach & Gage Company 45
Victory Safety Hammer Corp. .....
Viking Tool & Machine Corp. 188
Vimco Manufacturing Company 181

Walls Sales Corporation 173
Walton Company 185
Webber Gage Co. .....
Welch Industries, Inc. 29
Welding Equipment & Supply Co. 94
Wesson Company 163
Wheelock, Lovejoy & Company 163
Whistler & Sons, Inc., S. B. 104
Willey's Carbide Tool Company 170
Wittek Manufacturing Company 129

Yoder Sales Company .....
Yohe Supply Company, Wm. S. .....
Yost Mfg. Co. 179

Zagar Tool, Inc. .....



Precision STARTS WITH LITTLE THINGS • • • AS LITTLE AS .000001"

Surface smoothness (height, depth, pitch of each irregularity) is accurately measured to a millionth of an inch . . . precision at its finest . . . by the Brush Surface Analyzer.

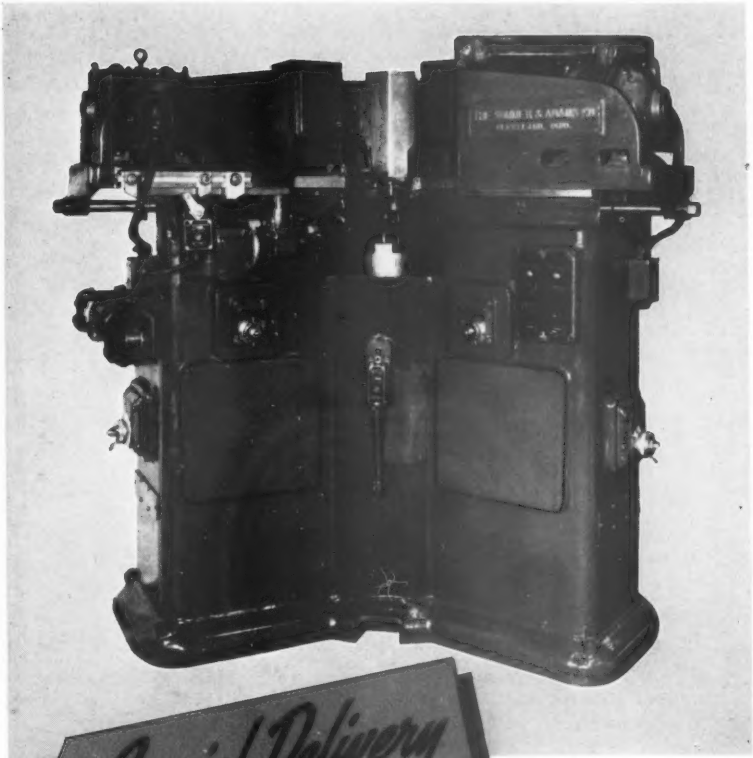
The movement of the diamond stylus is amplified up to 100,000 times and immediately recorded on a moving paper chart for permanent reference.

Readily operated anywhere by plugging into a 110 volt, 60 cycle, A. C. line.

BRUSH Crystal PRODUCTS

THE BRUSH DEVELOPMENT CO.

3311 PERKINS AVENUE • • CLEVELAND, OHIO



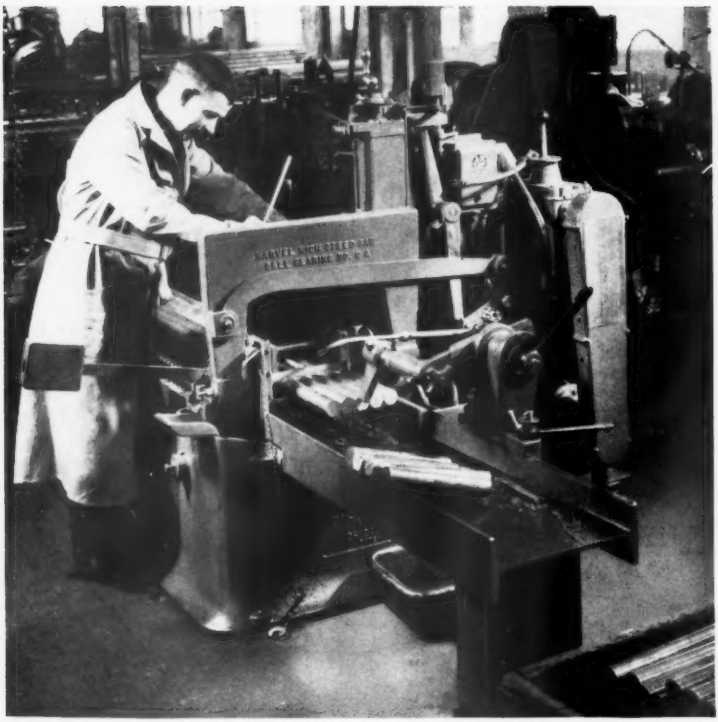
Special Delivery
FROM SOMMER & ADAMS

STILL ANOTHER WAR MACHINE! The Sommer & Adams Company again answers an urgent call by designing and building this 3-station hydraulically operated machine for notching three slots in the nose of a 75-millimeter shot body. Adaptations, of course, can be introduced to suit individual conditions. Why not put Sommer & Adams' 27-year background to work to meet your exact requirements in connection with special equipment?

S&A

THE SOMMER & ADAMS COMPANY
18511 EUCLID AVENUE • CLEVELAND, OHIO

Custom-Built EQUIPMENT FOR MANY PURPOSES



MARVEL 9A (capacity 10" x 10") Cutting-off shafts at the Monarch Tool Co.

Fine Machine Tool Builders Know Their Machine Tools!

When the Monarch Machine Tool Co., builders of Monarch Precision Lathes, needed another cutting-off machine, they chose a MARVEL 9A Production Saw... one of MARVEL'S new heavy-duty, all-ball-bearing sawing machines with automatic bar push up. These are the fastest saws built—will cut-off more pieces, floor-to-floor, from single or nested bars than can be cut-off by any other method.

Buy from your local distributor.

MARVEL SAWS

ARMSTRONG-BLUM MFG. CO. *"The Hack Saw People"*
5700 Bloomingdale Ave., Chicago, U.S.A. Eastern Sales: 225 Lafayette St., N.Y.